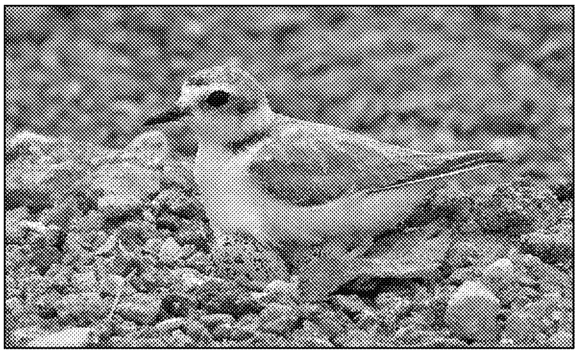
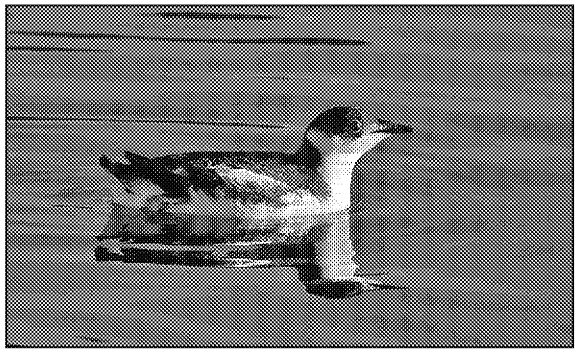
Offshore Oil and Gas Development and Production Activities in the Southern California Planning Area

Biological Assessment
U.S. Fish and Wildlife Service Regulated Endangered and Threatened Species





Prepared for the U.S. Fish and Wildlife Service

In Accordance with Section 7(c) of the Endangered Species Act of 1973, as Amended

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1. INTRODUCTION

Leasing, exploration, development and production of offshore oil and gas reserves on the outer continental shelf of the Pacific Coast began in the early 1960's. Initially, the Bureau of Land Management (BLM) was responsible for leasing areas of the outer continental shelf and the U.S. Geological Survey (USGS) provided oversight for exploration, development and production of offshore oil and gas resources. In 1982, the Minerals Management Service (MMS) was created to oversee all outer continental shelf oil and gas leasing, exploration, development and production. In 2010, MMS was renamed the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) and the Office of Natural Resource Revenues (ONRR) was spun off from BOEMRE that year. The following year, the Office of Natural Resource Revenues (ONRR) was created and BOEMRE was split into two new bureaus: the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE). With this reorganization, BOEM retains the authority for managing and issuing decisions on oil and gas leasing on the outer continental shelf, as well as approving exploration and development and production plans, and issuance of geological and geophysical permits. BSEE retains the authority to review and approve permits for drilling, rights-of-way and pipeline installations, decommissioning of offshore structures as well as day-to-day inspection and enforcement actions associated with offshore oil and gas production.

BOEM and BSEE are independent bureaus but their missions are clearly linked and they share many functions. For example, BOEM currently assists BSEE with environmental reviews and BSEE handles many human resource and administrative functions for BOEM. For this biological assessment, we reflect on past Endangered Species Act (ESA) consultations, identify reasonably foreseeable future BOEM and BSEE actions, and consider the potential effects of these actions on species currently listed by the U.S. Fish and Wildlife Service (USFWS) as endangered or threatened.

2. RANGE AND SCOPE OF FUTURE BOEM AND BSEE ACTIONS FOR OFFSHORE OIL AND GAS IN THE SOUTHERN CALIFORNIA PLANNING AREA

The range and scope of reasonably foreseeable future BOEM and BSEE (Bureaus) actions has been significantly reduced over the last 30 years. Lease sales and major construction activities identified in existing biological opinions have either been completed or abandoned. There are no plans to conduct new lease sales at this time and no new platforms are expected to be installed in the foreseeable future. Emphasis has shifted from leasing new areas to maximizing the development of oil and gas resources within the range of existing platforms and infrastructure. This programmatic biological assessment describes the current and expected level of activities associated with the continued development and production of oil and gas reserves within the Southern California Planning Area and reexamines potential effects on endangered and threatened species under USFWS jurisdiction.

This assessment is intended to supplement and combine earlier assessments and endangered species consultations for routine oil and gas development activities that are currently underway or are reasonably foreseeable in the Southern California Planning Area. The Bureaus will continue to coordinate with USFWS on future actions as they are considered in the Pacific Region. This on-going coordination may confirm that an action is included within the scope of this programmatic assessment or that additional consultation would be required. For example, decommissioning of offshore facilities is discussed in this document but the Bureaus anticipate that project specific coordination and consultation will be necessary when a detailed decommissioning plan is submitted.

Description of the Southern California Planning Area

The Bureaus' Southern California Planning Area extends from the Monterey/San Luis Obispo County line southward to the Mexican border and includes waters from 3-200 miles from shore. For the purpose of this biological assessment, the Southern California Planning Area is considered the action area for potential effects on endangered and threatened species.

As of March 2017, there are 41 active producing leases in the Southern California Planning Area with 23 Federal platforms and 213 miles of pipelines that transport oil and gas to shore. Since 1963, more than 1,450 exploration and development wells have been drilled in this area with more than 1.3 billion barrels of oil and 1.8 trillion cubic feet of natural gas produced through September 2016. There are now less than 400 active development wells at any given time and this number is not expected to change in the foreseeable future. Approximately 260 million barrels of oil and 540 billion cubic feet of natural gas are estimated to remain in oil and gas fields within reach of existing platforms in the Southern California Planning Area.

Oil production rates peaked at more than 200,000 barrels per day in1996 and have declined in subsequent years to a production rate of about 50,000 barrels per day. Since May 2015, oil production has been temporarily reduced to about 17,000 barrels per day as the result of an onshore pipeline failure.

Gas production has followed a similar declining trend with a production rate of about 77 million cubic feet per day. Gas production has also been affected by the 2015 onshore pipeline failure resulting in a temporary rate of about 13 million cubic feet per day.

Overall, offshore oil and gas production in the Southern California Planning Area is expected to continue to decline gradually over time with drilling and production activities continuing as long as oil and gas can be produced in paying quantities.[1]

BOEM/BSEE Actions and Activities

Brief descriptions of bureau actions and associated activities are provided below. They are listed in a roughly chronological order from leasing of the outer continental shelf to decommissioning (removal) of offshore oil and gas facilities including the bureau responsible for approving each activity. We do not expect all of these actions and activities to occur in the foreseeable future. We will continue to coordinate and consult with USFWS on future actions that are not considered ready for consultation at this time.

(1) LEASE SALES AND ISSUANCE OF LEASES (BOEM)

A primary BOEM function is the sale and issuance of Outer Continental Shelf leases for energy development; however, in the Southern California Planning Area no oil and gas leases have been offered since 1984. From 1984-2008, Congressional and Presidential moratoriums were in effect that prohibited oil and gas lease sales offshore California. Although these moratoriums were either rescinded or allowed to expire, planning areas offshore California were not included in BOEM's 2012-2017 leasing program and are not proposed for the 2017-2022 leasing program.

[1] Paying Quantity is an oil and gas lease term referring to a lessee's good faith judgment that production can continue to yield a profit.

Projected Activity: There are no plans to conduct oil and gas lease sales or issue new leases in the Southern California Planning Area and therefore we are not considering future leasing actions in this biological assessment.

(2) APPROVAL OF OIL AND GAS EXPLORATION PLANS AND GEOLOGICAL AND GEOPHYSICAL PERMITS

Exploration Plans: Upon issuance of a lease, drilling of exploratory wells and associated activities are subject to BOEM-approved exploration plans [30 CFR 550.201]. Since 1963, 295 exploration wells have been drilled in the Southern California Planning area with the last exploratory well completed in 1989 (MMS 1992). These exploratory wells were drilled using jack-up rigs, mobile offshore drilling units (MODUs) or ships. Currently there are no active exploration plans or exploratory drilling activities occurring in the Southern California Planning Area.

Geological and Geophysical Survey Permits: BOEM requires permits for geological and geophysical (G&G) surveys conducted for the purpose of collection of oil, gas or sulphur data on the Outer Continental Shelf whether they be for exploration or scientific research [30 CFR 551.4]. G&G surveys are generally exploratory in nature and precede lease sales but they may also be permitted to further delineate known oil and gas production fields. Permits may be issued with or without a lease and may include high energy seismic surveys.

In the Southern California Planning Area, the most recent G&G permit was issued by MMS in 1995 for delineation of an existing production field. In 1999, the California State Lands Commission, MMS and the National Marine Fisheries Service (NMFS) finalized a coordinated process for future review of G&G permit applications in the geographic area extending from the Monterey Bay National Marine Sanctuary south to the Mexican border in State and Federal waters (California State Lands Commission (CSLC) and MMS 1999). This High Energy Seismic Survey (HESS) review process was the result of a 2-year consensus-building effort among stakeholders. In this process, NMFS was identified as the lead agency for ESA consultations for high energy seismic surveys in recognition of their requirement to issue Incidental Harassment Authorizations (IHAs) under the Marine Mammal Protection Act.

Projected Activity: BOEM does not anticipate exploration plans to be submitted in the absence of a leasing program for the Southern California Planning Area, which is not reasonably foreseeable at this time. Likewise, requests for BOEM to permit G&G surveys in the Southern California Planning Area are not anticipated. We are not considering permitting of G&G surveys in this biological assessment. Should a G&G permit be requested and adverse effects are anticipated for species under the purview of the USFWS, we expect to coordinate and cooperate with USFWS at that time.

(3) APPROVAL OF OIL AND GAS DEVELOPMENT AND PRODUCTION PLANS AND PLAN REVISIONS (BOEM)

Offshore oil and gas development and production activities must be conducted in accordance with to plans approved by BOEM [30 CFR 550.201]. The content and level of detail for development and production plans in the Southern California Planning Area have varied over time but all describe proposed infrastructure (e.g., platforms, pipelines and power cables), activities and general strategies for production of oil and gas.

Discharges and Emissions: BOEM regulations require operators to submit a copy of their application for a National Pollutant Discharge Elimination System (NPDES) permit from Environmental Protection Agency (EPA) with their development and production plans [30 CFR 550.248]. BSEE regulations prohibit unauthorized discharges of pollutants into offshore waters [30 CFR 250.300]. Fluid and solid discharges from Federal oil and gas development and production facilities in southern California are authorized by EPA under general NPDES permit CAG 280000. This permit authorizes 22 types of discharges from all Federal offshore platforms in southern California including drilling muds and cuttings; produced water; well treatment, completion and workover fluids (including fluids associated with hydraulic fracturing and acidization); deck drainage; sanitary wastes and domestic wastes; non-contact cooling water; and fire control test water (EPA 2014). In 2013, EPA Region 9 re-evaluated the potential effects of these discharges on ESA listed species and critical habitat for the offshore lease blocks considered active by BOEM. They concluded that readily available evidence supports the conclusion that the discharges would have no effect on endangered or threatened species. They forwarded their conclusion to NMFS and received no comments (EPA 2013).

BOEM air emission information requirements for development and production plans are found at 30 CFR 550.249. In the Southern California Planning Area, responsibility for air quality management is delegated by EPA to local air quality control boards that monitor and enforce air quality requirements for offshore oil and gas development and production. BOEM and BSEE work with the local air quality control boards to ensure that their requirements are met.

Support Vessel and Operator Aircraft Activity: Day-to-day offshore oil and gas development and production operations require routine personnel and equipment transfers. Crew and supply boats depart the coast approximately 30 times per day along pre-determined routes from Seal Beach Pier (public pier, Orange County), Terminal Island (Port of Los Angeles), Port Hueneme, Carpinteria Pier (private pier, Santa Barbara County) and Ellwood Pier (private pier, Santa Barbara County) to nearby offshore platforms. Approximately 3-4 helicopter trips per day are used to transport personnel from the Santa Maria Airport to platforms north of Point Conception. Larger pieces of equipment and certain support services (e.g., commercial dive services) are mobilized from the Port of Long Beach, the Port of Los Angeles, Port Hueneme and, to a limited extent, Santa Barbara Harbor.

Platform Lighting: All offshore platforms provide lighting of all decks to maintain safe working conditions and support production operations conducted throughout the night. Using composite night satellite imagery, light emittance was measured at three typical platforms (Grace, Hermosa and Heritage) resulting in integrated density values ranging from 390 to 806 over a 12 square kilometer area for each platform (Hamer et al. 2014). On a clear night, all California platforms are visible from the nearby coast.

Projected Activity: All major construction activities, under approved development and production plans in the Southern California Planning Area, have either been completed or are no longer being considered. We do not anticipate new development and production plans to be submitted in the absence of a leasing program but existing plans may be revised or supplemented if substantive changes are made. BOEM's regulations at 30 CFR 550.283 provide specific instances where revisions to development and production plans are necessary: 1) Change in the type of drilling, production facility or oil/gas transportation mode; 2) Change in the location of a drilling or production facility; 3) Change in the type of production or significant increase in production volume or oil storage capacity; 4) Increased air emissions exceeding the amount specified in the development and production plan; 5) Significant increase in solid or liquid wastes handled or discharged; 6) Request for new hydrogen sulfide area classification; 7) Change in location of onshore support base from one State to another or expansion of a support base; or, 8) Change in other activity as specified by the Regional Supervisor.

Although we cannot predict what revisions may be requested, we are reviewing the effects of discharges, emissions, vessel use, aircraft use, and platform lighting under existing development and production plans in this assessment.

(4) APPROVAL OF APPLICATIONS FOR PERMITS TO DRILL AND APPLICATIONS FOR PERMITS TO MODIFY (BSEE)

General plans for drilling for oil and gas are included in exploration plans and development and production plans approved by BOEM. However, drilling of individual wells must be reviewed and approved by BSEE [30 CFR 250.410]. An Application for Permit to Drill (APD) is used to approve drilling specifications for new wells, new sidetrack wells, and bypasses or deepening of existing wells. Drilling of new wells may also include the installation of conductors which establish a conduit from the deck of the platform to the sea floor.

An Application for Permit to Modify (APM) is required when an approved APD is revised or materially changed [30 CFR 250 subpart D]. Well completion and workover operations are conducted to establish, maintain or restore production of a well and are generally approved with an APM [30 CFR 250 subparts E and F]. These operations may include hydraulic fracture treatments and other well stimulation techniques (e.g., acidization) that are designed to enhance recovery of oil and gas resources. BSEE may also issue well completion or workover field rules to modify specific requirements [30 CFR 250.512 and 30 CFR 250.612].

Well Stimulation Treatments: BSEE may authorize several types of well stimulation treatments through their approval of an APD or APM. These include:

Diagnostic Fracture Injection Tests – A diagnostic fracture injection test is used to estimate key reservoir properties and parameters that are needed to optimize a main fracture job. It is a short duration procedure that involves the injection of typically less than 100 bbl of fracturing fluid at pressures high enough to initiate a fracture. Key parameters are estimated from the fluid volume injected and the pressure dissipation profile. The fluid used in a diagnostic fracture injection test is typically the fluid that would be used in the main fracture treatment but with no proppant[2] added, thus allowing the fracture to close naturally as pressure is released.

Hydraulic Fracturing – Hydraulic fracturing involves the injection of a fracturing fluid at a pressure (as typically determined by a diagnostic fracture injection test) needed to induce fractures within the producing formation. The process generally proceeds in three sequential steps: (1) injection of a fracturing fluid without proppant to create fractures which extend out from the well; (2) injection of a slurry of fracturing fluid and proppant; and (3) injection of breakers, chemicals added to reduce the viscosity of the fracturing fluid. Upon release of pressure, the fracturing fluid is allowed to flow back (the flowback fluid) to the surface platform. Key fluid additives include polymer gels which increase the viscosity of the fluid and allow it to more easily carry proppant into the fractures, crosslinker compounds that help further increase the fluid viscosity, and breaker chemicals which break down the crosslinked polymers and allow

[2] A proppant is a solid material, typically sand, treated sand, or man-made ceramic materials, designed to keep an induced fracture open during or following a fracture treatment.

them to return more readily to the surface after fracturing is completed. Other important additives may include pH buffers, clay control additives, microbial biocides, and surfactants to aid in fluid recovery. In offshore applications, the base fracturing fluid is filtered seawater.

Acid Fracturing – Acid fracturing is similar to hydraulic fracturing except that instead of using a proppant to keep fractures open, an acid solution is used to etch channels in the rock walls of the fractures, thereby creating pathways for oil and gas to flow to the well. As with a hydraulic fracturing well stimulation treatment, a pad fluid is first injected to induce fractures in the formation. Next, the acid fracturing fluid is injected at pressures above the formation fracture pressure and allowed to etch the fracture walls. The acid fracturing fluid is typically gelled, cross-linked, or emulsified to maintain full contact with the fracture walls. Fifteen percent hydrochloric acid (15% HCl) solutions are typically used in carbonate formations such as limestone and dolomite, while hydrofluoric acid (HF) solutions and HCl/HF mixtures are used in sandstone and Monterey shale formations and in other more heterogeneous geologic formations, typically at levels of 12% and 3%, respectively. The fracturing fluid typically also includes a variety of additives at a combined concentration on the order of 1% or less, such as inhibitors to prevent corrosion of the steel well casing, and sequestering agents to prevent formation of gels or iron precipitation which may clog the pores.

Matrix Acidizing – In matrix acidizing, a non-fracturing treatment, an acid solution, is injected into a formation where it penetrates pores in the rock to dissolve sediments and muds. By dissolving these materials, existing channels or pathways are opened and new ones are created, allowing formation fluids (oil, gas, and water) to move more freely to the well. Matrix acidizing also removes formation damage around a wellbore, which also aids oil flow into the well. The acid solution is injected at pressures below the formation fracture pressure and is thus a non-fracturing treatment. Three distinct fluids are commonly used sequentially: (1) an HCl acid preflush fluid; (2) a main acidizing fluid generated from mixing HCL and ammonium bifluoride to produce an HCl/HF mud acid at typically 12% and 3%, respectively (some operations use mud acid while some operations primarily use 15% HCl); and (3) an ammonium chloride overflush fluid. The acidizing fluid also includes a variety of additives at a combined concentration of on the order of 1% or less, similar to those used in acid fracturing.

<u>Installation of Well Conductors</u>: BSEE may authorize installation of conductors with an APD. Conductors are large pipes that carry oil and gas from the sea floor to the deck of an offshore platform. They are inserted through "slots" in the platform structure that guide and support this component of a well. The majority of the conductors are installed when a platform is constructed but some slots may be left empty with a conductor being installed at a later date. Installation of a conductor may require impact, vibratory or rotary methods to drive the conductor into the sea floor thus making this operation analogous to a pile-driving operation.

The dimensions of the conductors, equipment used, specific location and timing are important variables when considering potential sound impacts. Where sound is expected to affect marine mammals an incidental harassment authorization will be required and NMFS will conduct an ESA consultation when specific information for a project becomes available. We expect to cooperate with NMFS in the preparation of ESA consultation documents as conductor installation projects are proposed.

Projected Activity. BSEE expects to review and approve approximately 1-2 new and 5-7 sidetrack wells (APDs) and 2-4 well workovers and up to 5 well stimulation treatments (APMs) per year in the Southern California Planning Area. Issuance of APDs for conductors installations are driven by availability of open slots and operator drilling plans. Requests for conductor installations are expected to be sporadic.

Of the more than 1,450 exploration and development wells that have been drilled in Federal waters on the Pacific Outer Continental Shelf between 1982 and 2014, there have been only 21 hydraulically fractured completions, and these were conducted on only 4 of the 23 platforms in the Southern California Planning Area. Three of these were in the Santa Barbara Channel, and the fourth was in the Santa Maria Basin. Only three matrix acidizing treatments, defined as well stimulation treatments, occurring in OCS waters during a similar time frame (between 1985 and 2011) have been identified in records, and these were conducted on only 2 of the 23 platforms.

Given the historic record well stimulation treatments in the Southern California Planning Area and the indicated plans for industry known at this time, we expect up to five well stimulation requests per year. This estimate is conservative in its approach, given that this potentially overestimates the potential for impacts since there is no year on record where five well stimulation treatments were approved. However, given the small number of operating platforms and the current level of oil and gas activities a higher number of well stimulation treatments proposed in a single year is not reasonably foreseeable.

(5) APPROVAL OF PIPELINE INSTALLATIONS AND PIPELINE MODIFICATIONS (BSEE)

Installation, modification or abandonment of offshore oil and gas pipelines requires approval by BSEE [30 CFR 250.1000]. All planned pipelines in the Southern California Planning Area have been installed. BSEE does occasionally receive requests for pipeline repair and/or replacement of existing pipelines.

Projected Activity: No pipeline applications are pending or expected at this time, however, we expect to coordinate and consult with USFWS as pipelines applications are received and when specific information (e.g., location, timing, methods and equipment requirements) for a project proposal becomes available.

(6) BSEE INSPECTION PROGRAM – HELICOPTER FLIGHTS (BSEE)

BSEE inspectors are on duty every day of the year to ensure compliance with BOEM and BSEE requirements. OCS helicopter traffic from the operators in the Pacific Region operates primarily out of Santa Maria, Lompoc, and Santa Barbara airports. BSEE maintains a contract for helicopter services for flights from Camarillo Airport to offshore platforms. During the past decade, helicopters have averaged approximately 3 to 5 trips per week per platform (Bornholdt and Lear 1995, 1997). Most of this traffic is to and from platforms in the western Santa Barbara Channel and Santa Maria Basin. Average flight usage over the last 5 years has been 45,000 to 50,000 miles per year. BSEE minimizes flight time by inspecting platforms in proximity to each other or dropping off inspectors at closer platforms before continuing to outlying platforms. Flight time is divided among all the facilities, but flight time to individual facilities can vary greatly depending on activity levels or complexity of the inspection mission and proximity of the platform to Camarillo Airport. Helicopter flight paths are generally over water but can vary dependent on weather conditions. Unless safety (e.g., poor visibility) is an issue, transit flight heights are generally maintained at levels greater than 500 feet. Note that BSEE inspectors may make use of operators' crew boats to access the offshore facilities. These boats make regularly scheduled transits to platforms and are addressed under the Support Vessel and Operator Aircraft activity above. BSEE inspectors never use an operator's helicopter to access platforms.

Projected Activity: The BSEE inspection program is expected to be active as long as oil and gas is produced offshore. Helicopter use is expected to continue at a level comparable to past years – 45,000 to 50,000 miles per year.

(7) BSEE INITIATED OIL SPILL RESPONSE EQUIPMENT EXERCISES (BSEE)

BSEE is expected to ensure that offshore operators have oil spill response plans and that they are prepared to implement these plans should an oil spill occur. To meet this expectation, BSEE periodically directs operators to deploy industry-owned oil spill response equipment listed in their response plans. For any given exercise, equipment deployed may include oil spill boom, mechanical skimmers, response vessels, oil storage equipment, aircraft and marker buoys as described below:

Oil Spill Boom – Booms are floating, physical barriers to oil, made of plastic, metal, or other materials, which slow the spread of oil and keep it contained. While booms can be seen above the waterline, they may have between 18 and 48 inches of material known as a "skirt" that hangs beneath the surface. The largest sizes of boom are used for offshore responses. Containment boom comes in lengths of 500 feet or more and can be connected together into lengths reaching 1,500 feet. Depending on the cleanup tactic being exercised, boom can be deployed directly from a facility by its assigned small boats[3] or by an oil spill removal organization (OSRO) deployed to the scene. For offshore operations boom may be deployed to completely encircle the platform. It may also be deployed in various configurations (i.e., U-shape, V-shape, J-shape) by one to three vessels coordinating their operations to simulate tactics for corralling spilled oil. When boom is deployed in the U-shaped, V-shaped, or J-shaped configurations, it is often done so in conjunction with a deployment of mechanical skimming device(s). For nearshore[4], boom designed for oil diversion or exclusion from sensitive areas can be of various shapes and lengths. Depending on the environmental conditions (i.e., sheltered harbor, fast currents) different boom sizes, means of floatation, and their means of inter-connection will need to be evaluated and selected. Boom deployed in nearshore and on-shore environments generally are moored in place with the use of anchor and weight systems or onshore staking.

Mechanical Skimmers - Skimmers are mechanical devices that remove free floating or corralled oil from the surface of the water. Depending on the specific model these devices can pump anywhere from 100 gallons per minute (gpm) to 1000 gpm. Two general types are commonly used in the Pacific Region. Weir skimmers come in several configurations and essentially work like a dam. The weir is adjusted to a height when deployed where oil floating on the water is drawn over the top of the dam at a collection inlet and store in a compartment connected to a pump inside the skimmer. Oleophilic surface skimmers are constructed with materials that attract oil and repel water. The material is incorporated into belts, disks, mop chains, or brushes which are squeezed or scraped in the skimmer to collect oil into various storage devices. Both types of skimmers can be constructed as a permanent part of a vessel's physical design or to float free from a vessel. For offshore oil cleanup, weir and oleophilic skimmers are generally deployed and

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[3] Presently, six of the Federal platforms and four platforms in state waters have boom stored onboard. The remaining facilities rely on boom supplied by an oil spill response organization.

[4] Nearshore, defined for the purposes of this document, is the ocean outside of the surf zone and within 1 mile of shore.

maneuvered by vessels through an oil slick to actively collect the oil. For example, a vessel can extend a short length of boom on a fixed arm (side collector) to herd oil to an inlet leading to a skimmer. As the vessel moves forward, oil is forced to accumulate in the apex of the boom where the skimmer is located, thereby concentrating the oil by increasing the amount of oil relative to water at the skimmer. Skimmers can also be deployed at an opening at the apex of two booms being towed between two vessels to recover oil that is forced into the apex. In this configuration, the collected oil is typically pumped to a storage barge or other vessel with containment tanks stationed near the apex.

Response Vessels – Self-propelled vessels stationed specifically at offshore facilities or provided by an oil spill response organization can engage in a variety of spill response activities. They serve as platforms to deploy and maneuver boom and mechanical skimmers, ferry equipment and personnel, conduct spill surveillance, apply dispersants, and to tow temporary oil storage devices and barges. Vessels used for these activities range in size from 12-ft skiffs to 207-ft oil spill response vessels. Some vessels used for spill response can achieve speeds up to 30 knots. They are usually dispatched within the first hour of a deployment exercise and achieve their highest speeds when transiting to the site of the simulated spill. Once on scene, vessels generally transit at very low speeds (0 to 5 kts) to conduct spill response operations.

Oil Storage Equipment – Towable temporary oil storage devices are designed to hold and transport recovered oil from a spill site. They are made of rubber or polymer-coated fabrics of various weights and designs and have capacities that range from a few gallons to more than 300,000 gallons. There are three types of towable temporary oil storage devices in use today. The first is a towable, rectangular-shaped, pillow tank, similar to those used on land (i.e., emergency potable water storage), but equipped with special tow rigging. The second type is a towable flexible tank, or "bladder," which is long and cylindrical in shape. When full, it is largely submerged and is characterized by flexibility along the length of the device. The third type of device is a towable open tank, an inflatable barge-type vessel with an open-top storage bag suspended inside the main structure. In addition to the temporary oil storage devices, metal or inflatable barges (sometimes called mini-barges) designed for temporary oil storage can be towed or pushed by a vessel during an exercise. These barges generally have a maximum storage capacity of 250 bbls and can be of various lengths.

Aircraft – Helicopters are versatile platforms that can be used for a number of spill response activities. During an exercise, they may be launched from the local Santa Barbara area to demonstrate remote sensing capabilities or simulate dispersant application in a designated offshore area. For the latter activity, helicopters equipped with 32-ft sprayer arms or suspended 250-gal buckets would fly over the exercise area and discharge water to simulate dispersant application. Helicopters may also be deployed in an exercise to drop an incendiary device such as a Heli torch to practice in-situ burn operations. However, it is anticipated that the latter exercise activity would be seldom performed and if conducted, would not involve a device that was actually ignited. Similar to rotary wing assets, fixed wing assets may be deployed in exercises to demonstrate remote sensing and dispersant application activities. For exercises in the Pacific Region, a King Air BE90 aircraft in Concord, CA and a C-130 aircraft in Mesa, AZ could be activated to conduct a coordinated simulated dispersant application operation. In such an exercise, BSEE would request the activation of both assets so that the King Air could provide spotter information to the pilots of the C-130 as the latter aircraft sprayed water in simulated dispersant application runs. This type of coordinated air operations would occur during an actual spill response and BSEE would use an exercise to evaluate the response times and effectiveness of the coordinated operations by the OSRP plan holder. Aerostats are balloon-like systems that are self-contained, compact platforms that can deploy multiple sensor payloads and other devices into the air. They can generally lift payloads less than 50 pounds and up to 500 ft into the air using a winch-controlled launch and recovery system from a vessel or platform. They are used to survey the extent of an oil spill and provide responders with real-time data to better guide operations.

Marker Buoys – Buoys may be used to demarcate the location of the simulated oil slick. They usually have a weighted, cone-shaped buoy body with a vertically extending narrow, fiber glass pole topped with a highly visible flag. Response vessels are to "capture the flag" to show success in a drill.

Projected Activity. Based on the number of oil spill response plans currently overseen by BSEE in the Pacific Region, normally three BSEE initiated oil spill exercises involving table-top scenarios and/or equipment deployments are conducted annually. However, more than three exercises may be initiated by BSEE if an owner/operator needs to be retested or if new oil spill response plans are approved in the Region. Equipment deployments during an exercise generally occur for a few hours and rarely longer than a day. BSEE will rarely initiate nighttime equipment deployment for safety reasons unless a low visibility response capability of an owner/operator needs to be evaluated. When mechanical skimmers are deployed and operated during an exercise, they are typically done so for approximately ten minutes to ensure that they are working properly. BSEE personnel will observe the operation of these devices and generally will be satisfied with their performance when the skimmers are sufficiently drawing and discharging water from and to the marine environment.

(8) DECOMMISSIONING (BSEE)

During exploration, development, and production operations. The seafloor around activity sites within a proposed lease sale area becomes the repository of temporary and permanent equipment and structures. The structures are generally grouped into two main categories depending upon their relationship to the platform/facilities. (i.e., piles, jackets, caissons, templates, mooring devises, etc.) or the well (i.e., wellheads, casings, casing stubs, etc.).

All 23 existing offshore platforms and associated pipelines in the Southern California Planning Area will be decommissioned after oil and gas reserves have been produced. BSEE approves permanent plugging of wells, full or partial removal of platforms and pipelines, and site clearance activities [30 CFR Subpart Q]. Offshore operators are required to submit applications for decommissioning to the BSEE Pacific OCS Region at least 2 years prior to ceasing oil and gas production.

Decommissioning of each platform may take more than a year of deconstruction effort depending on the size of the platform, location and availability of equipment. First, all wells will be permanently abandoned and well conductors and casings severed a minimum of 15 feet below the sea floor. Later, oil and gas processing equipment and deck modules (e.g., living quarters) will be removed and shipped to shore for disposal. The decks and supporting platform jacket (legs and cross members) will then be cut into smaller pieces for removal. A derrick barge with 500 to 2000 ton lift capacity will be required for lifts at the platform site along with one or more 300-400 foot cargo barges to transport recovered materials to shore.

A varied assortment of severing devices and methodologies has been designed to cut structural targets during the course of decommissioning activities. These devices are generally grouped and classified as either non-explosive or explosive, and they can be deployed and operated by divers, ROVs, or from the surface. Which severing tool the operators and contractors use takes into consideration the target size and type, water depth, economics, environmental concerns, tool availability, and weather conditions.

Nonexplosive severing tools are used for a wide array of structure and well decommissioning targets in all water depths. Based on 10 years of historical data (1994-2003) from the Gulf of Mexico, nonexplosive severing is employed exclusively on about 37% of platform removals per year. Common nonexplosive severing tools consist of abrasive cutters, diver cutting (e.g., underwater arc cutters and the oxyacetylene/oxy-hydrogen torches), and diamond wire cutters. Many removals in the Gulf of Mexico use explosive technologies either as a prearranged strategy or as a backup method.

Because of concerns over the use of explosives, current decommissioning cost projections for the Southern California Planning Area consider only the use of nonexplosive severing tools for disassembly of platform components; however, the use of explosives cannot be completely ruled out given safety concerns that may arise when considering cuts of this magnitude.

Explosive severance tools can be deployed on almost all structural and well targets in all water depths. Historically, explosive charges are used in about 63% of decommissioning operations in the Gulf of Mexico, often as a backup cutter when other methodologies prove unsuccessful. Explosives work to sever their targets by using (1) mechanical distortion (ripping), (2) high velocity jet cutting, and (3) fracturing or "spalling."

Mechanical distortion is best exhibited with the use of explosives such as standard and configured bulk charges. If the situation calls for minimal distortion and an extremely clean severing, then most contractors rely upon the jet-cutting capabilities of shaped charges. In order to "cut" with these explosives, the specialized charges are designed to use the high-velocity forces released at detonation to transform a metal liner (often copper) into a thin jet that slices through its target. The least used method of explosive severing in the Gulf of Mexico is fracturing which uses a specialized charge to focus pressure waves into the target wall and use refraction forces to spall or fracture the steel on the opposing side.

Offshore oil and gas facilities removed from state waters in California have required both nonexplosive and explosive devices. Devices to be used for the future removal of federal oil and gas facilities in the Southern California Planning Area have yet to be proposed.

Seafloor electrical cables running to shore will be completely removed (pulled onto a vessel) and pipeline segments in less than 200 feet of water will be removed up to the state water boundary. Other sections of pipeline in federal waters will be cleaned and abandoned in place or removed. The fate of pipeline segments in state waters will be determined by the California State Lands Commission.

After all decommissioning work is completed and the structure is salvaged, operators are required to perform site-clearance work to ensure that the sea floor of their lease(s) have been restored to pre-lease conditions. Based upon requirement found in 30CFR subpart Q, operators have the option of either trawling with commercial nets or conducting diver/high resolution sonar surveys of the lease site.

Detailed hypothetical decommissioning scenarios for individual platforms are described in BSEE's "Decommissioning Cost Update for Pacific OCS Region Facilities" (BSEE 2015).

Partial removal of offshore platforms is a possibility. BSEE supports and encourages the reuse of obsolete oil and gas structures as artificial reefs and is a cooperating agency in the implementation of the National Artificial Reef Plan. In California, any proposed reefing is subject to State legislation that would allow this activity. Structure removal permit applications requesting a departure from decommissioning regulations under the Rigs-to-Reefs Policy (BSEE Interim Policy Document 2013-07) undergo technical and environmental reviews. The policy document details the minimum engineering and environmental standards that operators/lessees must meet to be granted approval to deploy a structure as an artificial reef. Conditions of approval are applied as necessary to minimize the potential for adverse effects to sensitive habitat and communities in the vicinity of the structure and proposed artificial reef site. Additionally, structures deployed as artificial reefs must not threaten nearby structures or prevent access to oil and gas, marine minerals or renewable energy resources.

Projected Activity: Currently, no decommissioning applications for the Southern California Planning Area have been submitted. At this time, we are unable to reasonably predict when or where specific decommissioning activities will occur or describe specific activities that have yet to be proposed. This assessment provides a general overview of potential impacts associated with decommissioning. We expect to conduct additional consultations with USFWS after decommissioning applications are received and detailed descriptions of proposed activities are available.

3. FEDERALLY LISTED SPECIES/CRITICAL HABITAT CONSIDERED

Delisted Species Since Prior Consultations

Several species or taxa have been removed from the list of threatened and endangered species that were included in earlier consultations with the USFWS on BOEM's actions. The following species are no longer listed under the ESA and are not subject to consultation requirements pursuant to section 7:

- Aleutian Cackling (Canada) Goose (*Branta hutchinsii* [*canadensis*] *leucopareia*)
- Brown Pelican (*Pelecanus occidentalis*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- American Peregrine Falcon (*Falco peregrinus anatum*)
- Santa Barbara Song Sparrow (*Melospiza melodia graminea*) - extinct
- Island Night Lizard (*Xantusia* [=*Klauberina*] *riversiana*)

Listed Species not affected by the Proposed Action

Past consultations included many listed species that were considered but were later determined to not be affected by proposed offshore oil and gas activities. The current status of these species was reexamined, and listed species not considered in past consultations were also evaluated, in this programmatic biological assessment. We have determined that the continuation of existing offshore oil and gas development and production activities in the Southern California Planning Area will have no effect on the following listed species:

California Condor. The California Condor (*Gymnogyps californianus*) was listed as endangered on March 11, 1967 (32 FR 4001) and had critical habitat designated on September 22, 1977 (42

FR 47840). All free-ranging California Condors were removed from the wild by 1987 for captive breeding. Since 1992, California Condor chicks have regularly been released to the wild and the total world population now numbers about 400 birds; 235 of which are free-flying wild birds in California, Arizona, Utah, and Baja California (USFWS 2013a). In California, California Condors now inhabit the mountain ranges that surround the southern part of the San Joaquin Valley. Those that live along the coast in the Big Sur area on the Monterey County coastline have been observed feeding on whales (Order Cetacea), California sea lions (*Zalophus californianus*), and other marine species along the marine coastline (USFWS 2013a). We are not aware of any observations of California Condors feeding along the marine coastline south of Big Sur as most of the birds south of Monterey County are restricted to more inland mountain ranges in San Luis Obispo, Santa Barbara, Ventura, and Los Angeles Counties. Therefore, due to their absence from the marine coastline south of Monterey County, we have determined that the continuation of existing offshore oil and gas development and production in the Southern California Planning Area will have no effect on the California Condor.

California Ridgway's Rail. The California Ridgway's Rail (*Rallus obsoletus obsoletus*) (formerly California Clapper Rail (*Rallus longirostris obsoletus*) was listed as endangered on October 13, 1970 (35 FR 16047). This taxa was considered in two previous biological opinions (USFWS 1980a, USFWS 1983); both of which noted that this taxa may be vulnerable to an oil spill but recognized that oil spills from activities in the Southern California Planning Area were unlikely to affect occupied habitat. The California Ridgway's Rail is now generally restricted to the San Francisco Bay area and no longer occurs in the vicinity of the Southern California Planning Area. The California Ridgway's Rail was formerly a breeding species in Morro Bay and Elkhorn Slough, but was extirpated from those locations. The last breeding record for Morro Bay was in 1942 with casual visitants seen as late as 1972 (Marantz 1986), and the last Elkhorn Slough record was in 1980 (Roberson 2002). Records of California Ridgway's Rail sightings beyond San Francisco Bay are now sparse (USFWS 2013b). Due to the taxa's current distribution, we have determined that the continuation of existing offshore oil and gas development and production in the Southern California Planning Area will have no effect on the California Ridgway's Rail.

California Sea-blite. The California sea-blite (*Suaeda californica*), a plant found in tidally influenced areas, was listed as endangered on December 15, 1994 (59 FR 64613). A recovery plan was approved on August 27, 2013, and critical habitat has not been designated. Because the California sea-blite occupies such a narrow band in the intertidal zone, it is threatened by any natural processes or human activities that even slightly alter this habitat. Such threats include: increased sedimentation of Morro Bay, the encroachment of sand on the east side of the spit, and dredging projects within the channel of the bay (59 FR 64623).

The California sea-blite historically ranged from the San Francisco Bay estuary to Morro Bay. Today, the only naturally occurring populations are restricted to the coastal marsh habitat of Morro Bay, where it occurs in a very narrow band in the upper intertidal zone (USFWS 2013b) and occurrences at Old, San Geronimo, and Villa Creeks in the Cayucos area just north of Morro Bay (Walgren 2006). The distribution of California sea-blite around Morro Bay was mapped in the early 1990s (59 FR 64623). On the east side of the bay, colonies occur adjacent to the communities of Morro Bay, Baywood Park, and Cuesta by-the-Sea, although it apparently is absent from the more interior portion of the marshlands created by Chorro Creek runoff. On the west side of the bay, it is found along most of the spit, excepting the northern flank adjacent to the mouth of the bay. The California sea-blite's colonial habits make it difficult to estimate the population; however, one estimate places the number of individuals at no more than 500 (59 FR 64623). The species occurs north of any of the areas that oil spill modeling projects impacts occurring from an oil spill from offshore oil and gas facilities in the Southern California Planning Area. Therefore, we have determined that the continuation of existing offshore oil and gas development and production in the Southern California Planning Area will have no effect on California sea-blite.

Other listed species considered in past biological opinions that clearly occur outside the Southern California Planning Area and will not be affected by the reasonably foreseeable future proposed actions include the endangered salt marsh harvest mouse (*Reithrodontomys raviventris*), San Francisco garter snake (*Thamnophis sirtalis tetrataenia*), Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*), Callipe silverspot butterfly (*Speyeria callippe callippe*), San Bruno Elfin Butterfly (*Callophrys mossii bayensis*), Smith's blue butterfly (*Euphilotes enoptes smithi*), mission blue butterfly (*Icaricia icariodes missionensis*), and Menzie's wallflower (*Erysimum menziesii*).

Other listed species considered in past biological opinions due to the analysis of proposed onshore facilities at that time that no longer need to be considered include the endangered Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), Palos Verdes blue butterfly (*Glaucopsyche lygdamus palosverdesensis*), and El Segundo blue butterfly (*Shijimiaeoides battoides allyni*). No future onshore facilities are expected as a result of the reasonably foreseeable future oil and gas activities on the Pacific OCS.

San Clemente Island endemic species and taxa that were considered in previous biological opinions include the endangered San Clemente Island bush-mallow (*Malacothamnus clementinus*), San Clemente Island larkspur (*Delphinium variegatum* ssp. *kinkiense*), San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*), and San Clemente Bell's (Sage) Sparrow (*Artemisiospiza* [*Amphispiza*] *belli clementae*); and the threatened San Clemente Island lotus (*Acmispon dendroideus* var. *traskiae* [=*Lotus d.* subspecies *traskiae*]), and San Clemente Island Indian paintbrush (*Castilleja grisea*). Based on the GNOME and OSRA oil spill models, it is unlikely that oil from an accidental spill would contact San Clemente Island. In addition, the listed species present on the island are unlikely to be found in the intertidal zone where contact with oil could occur. Therefore, there will be no effect to the listed species on the island from the proposed activities.

In addition, there are a number of other species that have been listed since the last Southern California Planning Area-wide consultations were done, including a number of Channel Islands endemic species and including the endangered Santa Catalina Island fox (*Urocyon littoralis catalinae*), Catalina Island mountain-mahogany (*Cercocarpus traskiae*), Hoffmann's rock cress (*Arabis hoffmannii*), Hoffmann's slender-flowered gilia (*Gilia tenuiflora* ssp. *hoffmannii*), island barberry (*Berberis pinnata* ssp. *insularis*), island bedstraw (*Galium buxifolium*), island malacothrix (*Malacothrix squalida*), island phacelia (*Phacelia insularis* ssp. *insularis*), San Clemente Island woodland-star (*Lithophragma maximum*), Santa Barbara Island liveforever (*Dudleya traskiae*), Santa Cruz island bush-mallow (*Malacothamnus fasciculatus* var. *nesioticus*), Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*), Santa Cruz Island malacothrix (*Malacothrix indecora*), Santa Cruz Island rockcress (*Sibara filifolia*), Santa Rosa Island manzanita (*Arctostaphylos confertiflora*), and soft-leaved paintbrush (*Castilleja mollis*);

and the threatened island rush-rose (*Helianthemum greenei*) and Santa Cruz Island dudleya (*Dudleya nesiotica*). Based on the GNOME and OSRA oil spill models, oil from an accidental spill is not expected to contact San Clemente Island, Santa Catalina Island, or Santa Barbara Island. While some modeled trajectories do predict oil reaching the shores of Santa Cruz Island, Santa Rosa Island, and San Miguel Island the listed species present on those islands are not found in the intertidal zone where contact with oil could occur. Therefore, there will be no effect to these island-endemic listed species from the proposed activities.

Listed Species that may be affected by the Proposed Action

Short-tailed Albatross. The Short-tailed Albatross (*Phoebastria albatrus*) was listed as endangered on June 2, 1970 (35 FR 8491). It is also a California species of special concern. This species is a large pelagic bird with long narrow wings adapted for soaring just above the water surface. As of 2013, 78 percent of the known breeding population uses a single colony, Tsubamezaki, on Torishima Island off Japan. The remaining population nests on other islands surrounding Japan, primarily the Senkaku Islands. During the non-breeding season, the Short-tailed Albatross regularly ranges along the Pacific Rim from southern Japan to the Gulf of Alaska, primarily along continental shelf margins. It is rare to casual but increasing offshore from British Columbia to southern California (Howell 2012). All recent records along the west coast have been stage 1 immatures (Howell 2012), which travel more broadly throughout the north Pacific than adults (USFWS 2014). Most individuals found off California in recent years have been during the fall and early winter with a few records in late winter and early spring (California Birds Record Committee 2007). The diet of this species is not well studied; however, research suggests at sea during the non-breeding season that squid, crustaceans, and fish are important prey (USFWS 2008).

The global population is currently estimated to be 4,354 birds (USFWS 2014). There have been 40 records of the species off California since 1977 with 36 records between 1998 and 2014. Nine of the 40 records have occurred in the Southern California Planning Area off the coast of San Luis Obispo and Santa Barbara Counties, and around and beyond the Channel Islands. This species is not expected to occur with any regularity in the Southern California Planning Area site due to its rarity and the lack of records in the vicinity of the Project area; therefore, we have determined that the proposed activities are not likely to adversely affect this species and we will not discuss it further in this biological assessment.

Hawaiian Petrel. The Hawaiian Petrel (*Pterodroma sandwichensis*) was federally listed as endangered on March 11, 1967 (32 FR 4001). The species breeds on larger islands in the Hawaiian chain where they nest in burrows on vegetated cliffs, volcanic slopes, and lava flows. The global population is comprised of approximately 19,000 individuals which includes an estimated 4,500-5,000 breeding pairs (USFWS 2011; Lebbin et al 2010). The species is absent from Hawaiian waters from November-April when it disperses to the eastern tropical Pacific. Individuals have been recorded off of Oregon and California from April-October (Onley and Scofield 2007) with the California records occurring from April-early Sep. The first of California's 66 accepted records occurred in May 1992. There are 12 records in the vicinity of the Southern California Planning Area; 1 was nearshore and the other 11 were 24-100 miles offshore. Hawaiian Petrels with satellite transmitters have been tracked making regular foraging excursions to areas off northern California (where they are now seen regularly from boats and repositioning cruise ships off northern California in the summer), but there does not appear to be a regular pattern of occurrence off central and southern California. Therefore, it is not expected to occur with any regularity in the Southern California Planning Area and we have determined that the proposed activities are not likely to adversely affect this species and we will not discuss it further in this biological assessment.

Western Snowy Plover. The Pacific Coast population of the western snowy plover was listed as threatened on March 5, 1993 (58 FR 12864). The primary reasons for listing this population were loss and degradation of habitat, and human disturbance. A final recovery plan was signed August 13, 2007. Critical habitat for the species was originally designated in 1999 (64 FR 68507), revised in 2005 (70 FR 56970) and revised again in 2012 (77 FR 36728).

The Pacific Coast population of the Western Snowy Plover (*Charadrius nivosus nivosus*) breeds on the Pacific Coast from southern Washington to southern Baja California, Mexico. The bird is found on beaches, open mudflats, salt pans and alkaline flats, and sandy margins of rivers, lakes, and ponds. It nests in depressions in the sand above the drift zone on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creeks and river mouths, and salt pans at lagoons and estuaries. The breeding season extends from early March to late September, with birds at more southerly locations beginning to nest earlier in the season than birds at more northerly locations (64 FR 68507). In most years, the earliest nests on the California coast generally occur during the first to third week of March. Peak nesting in California occurs from mid-April to mid-June, while hatching lasts from early April through mid-August.

Snowy plover chicks are precocial, leaving the nest within hours after hatching to search for food. Adult plovers do not feed their chicks, but lead them to suitable feeding areas. The chicks reach fledging age approximately one month after hatching; however, broods rarely remain in the nesting area throughout this time. Plover broods may travel along the beach as far as 6.4 kilometers (4 miles) from their natal area.

Snowy plovers are primarily visual foragers. They forage for invertebrates across sandy beaches from the swash zone to the macrophyte wrack line of the dry upper beach. They also forage in dry sandy areas above the high tide, on salt flats, and along the edges of salt marshes and salt ponds (58 FR 12864).

In winter, the taxa is found on many of the beaches used for nesting as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats. The winter range is somewhat broader and may extend to Central America (Page et al. 1995). The majority of birds along the coast winter south of Bodega Bay, California (Page et al. 1986).

This species was formerly found on quiet beaches the length of the state, but it has declined in abundance and become discontinuous in its distribution. Habitat degradation caused by human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations have led to declines in nesting areas and the size of breeding and wintering populations (USFWS 2007a). The summer window survey conducted in 2014 found 2,016 birds throughout Washington, Oregon, and California.

In the Southern California Planning Area, Western Snowy Plovers breed or winter along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties from San Carpoforo Creek in northern San Luis Obispo County to Border Field State Park in San Diego County. They also occur on several of the Channel Islands including San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and San Clemente Islands. From 2010-2014, an average of 1,100 breeding adults occurred in this area, which is 58 percent of breeding adults in the range of the listed population. Significant breeding areas within this stretch of coast include the Morro Bay Sandspit, Oceano Dunes State Vehicular Recreation Area, the Guadalupe Dunes, Vandenberg Air Force Base beaches, Coal Oil Point, Ventura Beaches (McGrath, Mandalay, and Hollywood), Ormond Beach, Naval Base Ventura County, San Nicolas Island, the Bolsa Chica Ecological Reserve, and Camp Pendleton. The average number of wintering Western Snowy Plovers in this area from 2008/2009-2011/2012 was 2,463; approximately 70 percent of the wintering population along the California coast.

A revised designation of critical habitat for the Western Snowy Plover was published on June 19, 2012. This designation includes 60 units totaling 24,526 acres. Thirty-five of these units occur along the coast of the Southern California Planning Area, comprising 6,117 acres. This acreage is 25 percent of the total critical habitat designation.

Marbled Murrelet. The Marbled Murrelet (*Brachyramphus marmoratus marmoratus*) was federally listed as threatened on October 1, 1992 within the states of Washington, Oregon, and California (57 FR 45328). Populations of the species in Alaska and British Columbia were not listed under the ESA. The Marbled Murrelet is a small seabird that spends most of its life in the nearshore marine environment, but nests and roosts inland in low-elevation old growth forests, or other forests with remnant large trees. Critical Habitat for the species was designated on May 24, 1996 (61 FR 26256) and was later revised in a final rule published on October 5, 2011 (76 FR 61599). A final determination published on August 4, 2016 (81 FR 51348) determined that the critical habitat for the Marbled Murrelet, as designated in 1996 and revised in 2011, meets the statutory definition of critical habitat under the ESA. No marine areas were designated as critical habitat and none of the terrestrial units are south of the Santa Cruz Mountains (the southern extent of known breeding along the Pacific coast), which is approximately 100 miles north of the Southern California Planning Area.

While the species does not nest in the vicinity of the project area, individuals from the population nesting in the Santa Cruz Mountains (and perhaps from more northerly populations) do disperse to the coast and offshore waters of San Luis Obispo and Santa Barbara Counties. Marantz (1986) characterized them as a rare transient and winter visitant offshore, but possibly regular in late summer in San Luis Obispo County. Lehman (2014) described the species as a very rare late-summer, fall, and winter visitor along the coast of Santa Barbara County, but somewhat regular in late summer in the Point Sal/north Vandenberg Air Force Base area.

In a study where Marbled Murrelets nesting in the Santa Cruz Mountains were radiomarked (Peery et al. 2008), 3 of 46 birds (7%) radiomarked during the breeding season dispersed considerable distances (138-220 km) to the San Luis Obispo County coast. Nine of the 20 murrelets radiomarked in the postbreeding season dispersed long distances, 8 of which were relocated along the San Luis Obispo County coast after traveling 192-288 km. Their results indicate that the San Luis Obispo coast extending south to Point Sal in Santa Barbara County is an important wintering area for the species in central California (Peery et al. 2008).

A review of records in eBird (February 2015) shows observations along the coast from Arroyo de la Cruz in northern San Luis Obispo County to the Purisima Point area on Vandenberg Air Force Base. Areas with concentrations of Marbled Murrelet observations include San Simeon Bay, offshore of San Simeon State Park, Cayucos, Morro Bay, San Luis Obispo Bay, and off the Santa Maria River mouth. These records show peaks of occurrence along this stretch of coast in mid-January, May-early June, and mid-August-early November. Marbled Murrelets occur less frequently south of Point Conception; however, they are observed occasionally off of Ventura, along the Malibu coastline, and in Santa Monica Bay.

Marbled Murrelets forage at sea by pursuit diving in relatively shallow waters, usually between 20 and 80 meters in depth with the majority of birds found as singles or pairs in a band 300-2,000 meters from shore (Strachan et al. 1995). After the breeding season, some birds disperse and are less concentrated in nearshore coastal waters, as is the case with some other alcids. Ainley et al. (1995) conducted ship-based surveys off central California and detected most Marbled Murrelets with 7 kilometers of shore with the largest number occurring 3-5 kilometers offshore. They observed one individual 24 km offshore near the edge of the continental shelf break.

California Least Tern. The California Least Tern was listed as endangered on October 13, 1970 (35 FR 16047). The recovery plan for the species was published in 1980 (USFWS 1980b) and a revised recovery plan was later published in 1985 (USFWS 1985). Critical habitat has not been designated. The primary reasons for listing this species were loss of habitat, human disturbance, and predation. On October 2, 2006, the USFWS announced the completion of a 5-year review of the status of the California Least Tern, wherein they recommended it for downlisting from endangered to threatened (USFWS 2006a). However, a proposed rule to downlist the species has not been published to date so the status of the taxa remains endangered throughout its range.

The California Least Tern is a summer visitor to California that breeds on sandy beaches close to estuaries and embayments discontinuously along the California coast from San Francisco Bay south to San Diego County and south into Baja California. The earliest spring migrants arrive in the San Diego area after the first week in April and reach the greater San Francisco Bay area by late April (Small 1994). Nesting colonies are usually located on open expanses of sand, dirt, or dried mud, typically in areas with sparse or no vegetation. Colonies are also usually in close proximity to a lagoon or estuary where they obtain most of the small fish they consume, although they may also forage up to 3-5 km (2-3 miles) offshore. Nests consist of a shallow scrape in the sand, sometimes surrounded by shell fragments. Eggs (usually two per clutch) are laid from mid-May to early August. Incubation takes 20-28 days, and young fledge in about 20 days (USFWS 1980b). Least terns are fairly faithful to breeding sites and return year after year regardless of past nesting success. In the Southern California Planning Area, California Least Terns breed along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, and Orange Counties from Oceano Dunes in San Luis Obispo County to the Tijuana River Estuary in San Diego County. Fall migration begins the last week of July and first week of August (USFWS 2006a) when the subspecies departs for its wintering grounds in Central and South America. Most individuals are gone from southern California by mid-September.

In 1970, when the California Least Tern was listed as endangered by the federal government and California, its population in California was estimated at 600 breeding pairs. Population growth rates have increased, especially since the mid-1980s, when active management was initiated at breeding colonies. Although the increase in the breeding population has not been consistent from year to year, the long-term trends have shown steady population growth. Fluctuations in the California Least Tern population are thought to be attributable to a combination of high levels of predation and low prey availability.

In the general area of the Southern California Planning Area, as many as 26 sites were used for nesting by California Least Terns in 2015. Rangewide survey results from 2015 reported a minimum of 3,737 breeding pairs, maximum of 4,800 breeding pairs, and 4,982 nests in this region, which is approximately 91 percent of the nesting population and effort in California (Frost 2015). Significant breeding areas within this stretch of coastline include Oceano Dunes, Vandenberg Air Force Base, McGrath State Beach, Hollywood Beach, Point Mugu, Venice Beach, Los Angeles Harbor, Seal Beach National Wildlife Refuge (NWR), Bolsa Chica Ecological Reserve, Huntington State Beach, Upper Newport Bay, Camp Pendleton, Batiquitos Lagoon, Mission Bay, Naval Base Coronado, Sweetwater Marsh NWR, and Tijuana River Estuary.

Studies conducted at some of the larger colonies in southern California show that at least 75 percent of all foraging activity during breeding occurs in the ocean (Atwood and Minsky 1983). Approximately 90-95 percent of ocean feeding occurred within 1 mile of shore in water depths of 60 feet or less. California Least Terns were rarely seen foraging at distances between 1-2 miles from shore and were never encountered farther than 2 miles offshore (Atwood and Minsky 1983). However, there is evidence of some migration off California that occurs as far as 20 miles offshore or more based on observations off southern California (Pereksta, pers obs.). Further evidence offshore Mexico possibly corroborates these observations (Howell and Engel 1993; Ryan and Kluza 1999).

Light-footed Ridgway's Rail. The Light-footed Ridgway's Rail (*Rallus obsoletus levipes*) (formerly Light-footed Clapper Rail [*Rallus longirostris levipes*]) was listed as endangered on October 13, 1970 (35 FR 8320). A recovery plan was approved in 1979 (USFWS 1979). Critical habitat has not been designated for this subspecies. Habitat loss and degradation were the primary reason for ESA listing.

Light-footed Ridgway's Rails inhabit coastal salt marshes from the Carpinteria Marsh in Santa Barbara County, California, to Bahia de San Quintin, Baja California, Mexico (Zembal 1989, Zembal et al. 1998). The Light-footed Ridgway's Rail is normally found in estuarine habitats, particularly salt marshes with well-developed tidal channels. Dense growths of cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) are conspicuous components of rail habitat, and nests are located most frequently in cordgrass. Light-footed Ridgway's Rails construct loose nests of plant stems, either directly on the ground when in pickleweed or somewhat elevated when in cordgrass (USFWS 1979). Although nests are usually located in the higher portions of the marsh, they are buoyant and will float up with the tide. Eggs are laid from mid-March to the end of June, but most are laid from early April to early May. The incubation period is about 23 days, and young can swim soon after hatching.

Although, historically, most of the salt marshes in this region were probably occupied by rails, no more than 24 marshes have been occupied since about 1980 (Zembal and Hoffman 1999). There are currently believed to be approximately 500 pairs left in California, with most found in Upper Newport Bay, Seal Beach, and the Tijuana Marsh. The vast majority (more than 95 percent) of the remaining rails are in Orange and San Diego Counties. In 2013, a total of 525 pairs of Light-footed Ridgway's Rails exhibited breeding behavior in 22 marshes in southern California (Zembal et al 2013). This is the largest statewide breeding population detected since the counts began in 1980, and represents an 18.5 percent increase over the former high count in 2007. It also represents the third successive year of record-breaking high counts. The status of the Light-footed Ridgway's Rail in Mexico is not well documented. Surveys were conducted at several marshes in the 1980s, but a recent abundance estimate is not available (USFWS 2009).

In the general area of the Southern California Planning Area that could be impacted by oil spills, there are presently only two marshes that are, or have the potential to be, occupied by Light-footed Ridgway's Rails. These are Carpinteria Marsh in Santa Barbara County and Mugu Lagoon in Ventura County. The next closest occupied location is the Seal Beach NWR in Orange County. These locations represent the northern extent of the subspecies range along the California coast. The Light-footed Ridgway's Rail subpopulation at Mugu Lagoon fluctuated between 3 and 7 pairs for nearly 20 years until recent augmentations with translocated birds from Newport Bay fostered its growth. During the last 5 years (2010-2014) there was an average of 18 pairs and 5 unmated males in Mugu Lagoon on Naval Base Ventura County (Navy In Litt 2015). The increased population at this location appears to have led to an expansion of habitat use within the lagoon. For example, in 2004, a pair of rails was observed attempting to breed in the eastern arm of the lagoon for the first time in many years (Zembal et al 2006). In Santa Barbara County, the taxon was formerly more widespread, but the loss of habitat and other factors restricted it to the Carpinteria Salt Marsh during the latter 1900s (Lehman 2014). Approximately 20 pairs were there in the early 1980s dropping to just one individual by 2004. None were recorded after 2004 until a single individual was heard vocalizing there in 2011.

Southern Sea Otter. The southern sea otter (*Enhydra lutris nereis*) was listed as a threatened species on January 14, 1977 (42 FR 2968). The original recovery plan was finalized in 1982 (USFWS 1982). A revised recovery plan was finalized in 2003 (USFWS 2003). No critical habitat has been identified for this species. The primary reasons for listing the southern sea otter were 1) its small population size and limited distribution, and 2) the threat of oil spills, pollution, and competition with humans. A three-year running average of spring survey counts is used as an index for southern sea otter abundance. In 2016, this average was 3,272 sea otters (USGS 2016).

Currently, the range of the mainland population extends from Pigeon Point in the north to Gaviota State Beach in the south (Tinker and Hatfield 2015). In addition, there is a population near San Nicolas Island that is the result of translocations of 139 southern sea otters done by the USFWS between August 1987 and July 1990 to reduce the probability that a single natural or anthropogenic catastrophic event (e.g., large oil spill) would affect a large proportion of the population (USFWS 2000). Although the program succeeded in establishing a small colony of otters in southern California, USFWS formally terminated the program in December 2012 (77 FR 75266) citing overall recovery objectives and the value of allowing natural range expansion of sea otters into southern California.

Sea otters typically inhabit shallow nearshore waters with rocky or sandy bottoms supporting large populations of benthic invertebrates (Riedman 1987). Observed densities are higher over rocky (about 5/km^2) than sandy habitat (about 0.8/km^2) (Riedman and Estes 1990). In California, otters live in waters less than 18 m deep and rarely move more than 2 km offshore (Riedman 1987).

Sea otter home ranges generally consist of several heavily used areas connected by travel corridors (Riedman and Estes 1990). Males generally have larger home ranges, due in part to seasonal movements they make to either end of the parent range. These migrations coincide with the breeding season (June to November) and the non-breeding season (November to May). During the breeding season, the size of the southernmost group declines dramatically, due to a general northward movement of animals towards the center of the range (Bonnell et al. 1983; Estes and Jameson 1983). This movement of males from the population fronts into the more established areas occupied by females during the summer and fall breeding season is a feature of the sea otter's annual cycle (Bonnell et al. 1983). Recent studies also suggest that resource limitations near the center of the otter's range may be influencing these migration movements (USDOI/MMS 2006). Female otters are more sedentary, but are also known to travel long distances (Riedman and Estes 1990). Sea otters breed and pup throughout the year in all parts of the range, but there appear to be one or more peaks in most areas (Riedman 1987; Rotterman and Simon-Jackson 1988). In California, peak pupping occurs from January through March (Riedman and Estes 1990).

Recent southern sea otter surveys coordinated annually by USGS off the coast of California have shown substantial increases in the otter population. For example, in 1990 the population was 1,680 individuals. The population has steadily climbed since then and the most recent spring survey in May 2016 counted 3,511 sea otters, the highest count on record (Tinker and Hatfield 2016). As individual year counts may be highly influenced by survey conditions, the final revised recovery plan for the southern sea otter recommends using the 3-year running average as the official benchmark of the sea otter population status (USFWS 2003). The current 3-year running average of the mainland range is 3,194; also the highest average on record, which reflects an increasing trend of approximately 3% per year (Tinker and Hatfield 2016).

Range expansion to the south has brought an increasing number of southern sea otters into the Southern California Planning Area. During annual spring surveys conducted since 1983, the population of southern sea otters between Cayucos and Gaviota has grown from a total a total of 117 otters in 1983 to 800 individuals in 2016 (Tinker and Hatfield 2016). While annual numbers have fluctuated over this time, the most recent 5-year mean of otters for that region is 701 individuals. This southern portion of the range comprises approximately 23 percent of the total 2016 population of 3,511 (Tinker and Hatfield 2016). In 2006, the southern-most otter sighting occurred at Tajiguas, Santa Barbara County, just west of Refugio State Beach (Hatfield USGS, pers. comm.). The spring survey in 2015 found a slight range retraction south of Point Conception towards Gaviota State Beach (Tinker and Hatfield 2015). The range had expanded east to the Goleta area in recent years before this shift back to the west.

While the annual spring sea otter counts south of Cayucos have increased from more recent historical counts, there is a recent decreasing 5-year trend of approximately -0.6 percent per year in this region. This decreasing trend is consistent with an increase in shark bite mortality over the last 10 years in this peripheral area of lower population density. Notably, the specific area where the population trend is most negative (from Cayucos to Point Conception) coincides exactly with an area of increased shark bite mortality (Tinker and others 2015). The lack of population growth at the southern periphery over recent years likely explains the cessation of range expansion, as it is growth at the range ends that typically fuels range expansion (Tinker and others 2008; Lafferty and Tinker 2014).

The translocated southern sea otter population at San Nicolas Island has also increased in recent years. Counts throughout the 1990s generally recorded between 11-21 individuals. Over the last fifteen years, that number has steadily increased to a high count of 104 individuals in 2016 (Tinker and Hatfield 2016). The current 3-year average at San Nicolas Island is 78 individuals, which continues a positive trend of approximately 13% per year (Tinker and Hatfield 2016). The overall 5-year trend for southern sea otters (including both the mainland and San Nicolas Island populations) is 3.2% per year.

California Red-Legged Frog (*Rana aurora draytonii*). The California red-legged frog was federally listed as threatened species on May 23, 1996 (61 FR 25813). A recovery plan for the species was finalized in 2002 (USFWS 2002). Critical habitat was designated in 2006 (71 FR 19244) and revised in 2010 (75 FR 12816). The California red-legged frog has been extirpated from 70 percent of its former range and is threatened in its remaining range by a wide variety of human impacts, including urban encroachment, construction of reservoirs and water diversions, introduction of exotic predators and competitors, livestock grazing, and habitat fragmentation.

The California red-legged frog occupies a fairly distinct habitat, combining both specific aquatic and riparian components (Hayes and Jennings 1988; Jennings 1988). Adults require dense, shrubby or emergent riparian vegetation closely associated with deep (>0.7 m) still or slow moving water (Hayes and Jennings 1988). The largest densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings 1988). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. Adult frogs may be found seasonally in the coastal lagoons of the central California coast. They move upstream to freshwater when sand berms are breached by seawater from storms or high tides.

California red-legged frogs breed from November through March, with earlier breeding records occurring in southern localities (Storer 1925). Egg masses that contain about 2,000-5,000 eggs are typically attached to vertical emergent vegetation, such as bulrushes or cattails. California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto 1984). Eggs hatch in 6-14 days (Jennings 1988). Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer 1925; Wright and Wright 1949).

Sheltering habitat for the California red-legged frog is potentially all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs; industrial debris; and agricultural features, such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks. Incised stream channels with portions narrower than 18 inches and depths greater than 18 inches may also provide sheltering habitat.

California red-legged frogs are sensitive to high salinity (USFWS 2002). When eggs are exposed to salinity levels greater than 4.5 parts per thousand, 100 percent mortality occurs, and larvae die when exposed to salinities greater than 7.5 parts per thousand (Jennings and Hayes 1990). Nussbaum et al. (1983) stated that early-stage northern red-legged frog *(R. a. aurora)* embryos were tolerant of temperatures only between 48 and 70 degrees Fahrenheit; both the lower and upper lethal temperatures are the most extreme known for any North American ranid frog. Reis (1999) found that water temperature in a coastal marsh was the most important of three variables in differentiating between sites with egg masses and sites without. Salinity was not as critical in differentiating between sites with egg masses and without; however, salinity levels of 6.5 ppt or less was an important predictor for the presence of California red-legged frog tadpoles.

California red-legged frogs are known to occur in 243 streams or drainages in 22 counties, primarily in the central coastal region of California. The term "drainage" is used to describe named streams, creeks, and tributaries from which California red-legged frogs have been observed. A single occurrence of California red-legged frog is sufficient to designate a drainage as occupied by, or supporting California red-legged frogs. Monterey (32), San Luis Obispo (36), and Santa Barbara (36) counties support the greatest number of currently occupied drainages. Historically the California red-legged frog was known to occur in 46 counties, but is now extirpated from 24 of those counties (a 52-percent reduction in county occurrences).

There are five critical habitat units that include coastal areas that have a boundary with the coastline in the Southern California Planning Area (SLO-2, SLO-3, STB-4, STB-5, STB-6) and include watersheds that flow into the ocean or coastal lagoons. The physical and biological features essential to the conservation of the species (primary constituent elements) that are encompassed within these units include aquatic breeding habitat, aquatic non-breeding habitat, upland habitat, and dispersal habitat. The Piedras Blancas to Cayucos Creek Unit (SLO-2) is comprised of 82,673 acres along the coast in northwestern San Luis Obispo County, the Willow and Toro Creeks to San Luis Obispo Unit (SLO-3) is comprised of 116,517 acres near the coast in central San Luis Obispo County, the Jalama Creek Unit (STB-4) is comprised of 7,685 acres along the coast in southwestern Santa Barbara County south of the City of Lompoc, the Gaviota Creek Unit (STB-5) is comprised of 12,888 acres along the coast in southern Santa Barbara County, and the Arroyo Quemado to Refugio Creek Unit (STB-6) is comprised of 11,985 acres along the coast in southern Santa Barbara County (75 FR 12816).

Tidewater Goby. The tidewater goby (*Eucyclogobius newberryi*) was listed by the USFWS as endangered on February 4, 1994 (59 FR 5498). On June 24, 1999, the USFWS published a proposed rule to remove the northern populations of the tidewater goby from the endangered species list; the proposed rule was withdrawn on November 7, 2002. A final recovery plan for the species was completed on December 7, 2005 (USFWS 2005). Critical habitat for this species was designated on November 20, 2000 (65 FR 69693) revised on January 31, 2008 (73 FR 5920), and revised again on February 6, 2013 (78 FR 8746).

The tidewater goby ranges from Del Norte County (near the Oregon border) south to Agua Hedionda Lagoon in northern San Diego County. Most are found very close to the coast, though a few have been found as much as 8 km (5 mi) inland. Primary tidewater goby habitat is found in small, shallow coastal lagoons that are separated from the ocean most of the year by beach barriers. They are typically found in water less than 1 meter (3.3 feet) deep (USFWS 2005). This includes shallow areas of bays and areas near stream mouths in uppermost brackish portions of larger bays. Tidewater gobies are absent from areas where the coastline is steep and streams do not form lagoons or estuaries. Although tidewater gobies can tolerate full seawater, they are most common in waters with salinities of less than 12 parts per thousand. Adults are benthic, and larvae are briefly pelagic (Love 1996). The tidewater goby is threatened primarily by modification and loss of habitat as a result of coastal development, channelization of habitat, diversions of water flows, groundwater overdrafting, and alteration of water flows.

Tidewater goby populations may fluctuate seasonally. They are found in small groups or in aggregations of hundreds. The tidewater goby is typically an annual species, with few individuals living longer than a year. Reproduction in the tidewater goby occurs year-round, although distinct peaks in spawning, often in early spring and late summer, do occur. Females are oviparous and generally produce between about 300 to 500 eggs per clutch, and between 6 to 12 clutches per year. After the male goby has excavated a vertical burrow in coarse sand, a female will lay the eggs on the roof and sides of the burrow, suspending them one at a time. The males guard the eggs until they hatch in 9-10 days (Love 1996).

At the time of listing in 1994, tidewater gobies were known to have occurred in at least 87 of California's coastal lagoons, but were considered extirpated in approximately half of these (USFWS 2005). These assessments, however, followed a prolonged period of drought, when conditions in many habitats were at extremely low levels. Subsequent surveys found that populations in several locations had become re-established, or had been overlooked in the initial surveys. Additionally, new populations continue to be discovered, increasing the number of known historic populations to 135 (USFWS 2005). Of these 135 localities, 29 (21%) are believed to be extirpated; therefore, 106 localities are presumed to be currently occupied (USFWS 2007b). Currently, the tidewater goby is found in approximately 64 localities within San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties (USFWS 2007b).

Tidewater goby critical habitat units have been designated along the coast adjacent to the Southern California Planning Area including 12 units in San Luis Obispo County, 12 units in Santa Barbara County, 4 in Ventura County, 4 in Los Angeles County, 1 in Orange County, and 1 in San Diego County. While there are no BOEM/BSEE regulated activities in these units, there is a potential for spilled oil to impact these areas under conditions that allow oil to enter any of these coastal lagoons.

The primary constituent elements of critical habitat for the tidewater goby are persistent, shallow, still-to-slow-moving lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following: (a) Substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction; (b) Submerged and emergent aquatic vegetation that provides protection from predators and high flow events; or (c) Presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity.

Salt Marsh Bird's-Beak. The salt marsh bird's-beak (*Cordylanthus maritimus* ssp. *maritimus*) was listed as endangered on September 28, 1978 (43 FR 44812). A recovery plan for this species was approved in 2013. Critical habitat has not been designated.

Salt marsh bird's-beak is a diffusely branched annual herb in the figwort family (Scrophulariaceae). These plants are hemiparasitic, sometimes obtaining moisture and nutrients from the roots of their host plants, which are usually perennials. This plant is generally restricted to coastal salt marshes where its primary habitat is the upper salt marsh that is inundated by tides on a regular basis, but above areas that receive daily salt flooding. Plants may also occur behind barrier dunes, on dunes, mounds, and occasionally in areas with no tidal influence.

This plant occurs in salt marshes from Morro Bay in San Luis Obispo County south to San Diego County and Northern Baja California, Mexico. This taxa is currently known to persist in seven coastal salt marshes: San Diego County at Tijuana Estuary (separated into Border Field State Park and Tijuana Slough NWR, Naval Radar Receiving Facility (NRRF), and Sweetwater Marsh Unit of San Diego Bay NWR; Orange County at Upper Newport Bay (State) Ecological Reserve; Ventura County at Naval Base Ventura County, Point Mugu; Santa Barbara County at Carpinteria Salt Marsh; and San Luis Obispo County at Morro Bay. All of these sites are adjacent to the Southern California Planning Area. Destruction and modification of the coastal marshes is the primary reason for this plant's decline. Even minor alterations of the marsh that result in permanent changes in the natural tidal dynamics can make previously suitable habitat unsuitable. Changes in tidal inundation have affected plants by: smothering them with increased debris deposited by high tide, encouraging other marsh vegetation which shades out plants, or decreasing germination of seeds by lowering or increasing soil salinity (USFWS 1984).

4. Effects Analysis

4.1 Artificial Lighting

Nocturnal oceans are flat, dark environments where many seabirds are nocturnally active to avoid avian predators, primarily gulls (Montevecchi 2006). Saleh (2007), Schaar (2002), Anonymous (2002), Harder (2002), and Rich and Longcore (2006) summarize several of the more recent studies on the effects of artificial light on wildlife. These studies suggest that artificial light effects include disorientation, mortality due to collisions with lighted structures, and interruption of natural behaviors. Birds that spend most of their lives at sea are often highly influenced by artificial lighting in coastal areas and dark ocean environments. Intense source points of artificial lighting on the ocean can attract marine birds from very large catchment areas (Rodhouse et al. 2001, Wiese et al. 2001). The species that are potentially the most vulnerable to attraction to artificial lighting in marine environments are nocturnal species that are at risk and endangered and whose populations are small and fragmented (Montevecchi 2006).

Gauthreaux and Belser (2006) suggest that night-migrating birds showed "nonlinear flight" near towers with white and red strobe lights; however, they also stated that the attraction may have been more attributable to the constant tower lighting with the red strobe lights. Poot et al. (2008) found that white and red light interfere with the magnetic compass of migrating birds, where they caused disorientation at low light intensity, compared to a high-intensity green light that caused less disorientation. The researchers concluded that the disorientation is due to the wavelength; green and blue lights have a short wavelength resulting in very little observable impact to birds orientation. In 2007, lights on gas-production platform L15 in the North Sea were replaced with green lighting. Based on comparisons to previous assessments of L15, it was concluded that 2-10 times less birds are negatively impacted (circling around the installation for a prolonged period of time) by the new light source as by the original standard white (tube lights) and orange (sodium high pressure lights) lighting (Van de Laar 2007). In addition, the number of birds actually landing on the platform was decreased. The platform is still visible from a distance with the new lighting and the platform crew has commented that the lighting is less blinding and they have increased contrast vision during crane operations (Poot et al. 2008).

Fledgling storm-petrels, shearwaters, and some alcids are more attracted to artificial lights than are adults. This attraction likely results from disorientation associated with environmental inexperience or possibly from predispositions to find bioluminescent prey at sea (Imber 1975). Some species of petrels and storm-petrels, including several endangered or threatened species, incur considerable fledgling mortality as a result of artificial light attraction (Telfer et al. 1987, Bretagnolle 1990, Whittow 1997, Mougeot and Bretagnolle 2000, Day et al. 2003). The varying age-class attraction suggests that older birds may learn not to approach artificial light sources (Montevecchi 2006).

Migratory periods are critical times for mortality associated with artificial lighting at coastal and offshore sources. High proportions of relatively easily disoriented young-of-the-year are on the wing in the autumn and large numbers of seabirds move across oceans and hemispheres during the spring and fall.

Podolsky (2002) indicates that artificial lighting appears to "confuse" seabirds, particularly during their migration between urbanized nesting sites and their offshore feeding grounds.

Direct effects to seabirds include collisions with lighted structures or the light fixtures (Montevecchi 2006). Mass collisions of birds with lighted structures can result in high levels of mortality. Mass collisions and incidences of hundreds, thousands, and tens of thousands of circling birds have been reported at coastal and offshore artificial light sources (Bourne 1979, Wiese et al. 2001). Seabirds are attracted to the flares of offshore oil and gas platforms and can be killed by intense heat, collisions with structures, and by oil on and around the platforms (Wiese et al. 2001, Burke et al. 2005). Both the intensity and oceanographic novelty of these light sources could have a cumulative effect on the attraction and mortality of seabirds.

Indirect effects associated with artificial lighting are difficult to document. The holding or trapping of migrating birds at intense light sources can deplete their energy reserves, leaving them incapable of making it to nearest landfalls (Montevecchi 2006). Energy depletion in migratory seabirds could have severe consequences for winter survival or reproduction. Lighting could also attract predators (eg., gulls and Peregrine Falcons) to the vicinity of offshore platforms, which in turn could predate upon nocturnal seabirds attracted by artificial lights.

The Pacific OCS platforms are currently and will continue to be lit for compliance with U.S. Coast Guard (USCG) navigational hazard requirements during routine operations. Lighting on the platforms will be sufficient to assure safe operations and to be in compliance with USCG navigation hazard requirements but are not expected to result in significant impacts to the marine wildlife found in the region if the recommended mitigations are implemented. Recent observations from platforms Irene, Hermosa, Gail, Gina, and Edith by Reitherman and Gaede (2010) in the fall of 2010 indicated that bird species observed during 20 night monitoring events showed no signs of being attracted to or confused by the lit platforms they were monitoring. In addition, Reitherman and Gaede did not observe any evidence of birds deviating significantly from there predetermined migratory pathway. It is not known whether or to what extent such attraction disrupts migration or foraging behavior.

Nighttime marine construction is anticipated for some of the proposed actions including the eventual decommissioning of the platforms and therefore lit project vessels are expected to be present at project sites or while transiting between the port and the project sites. USCG-required vessel lighting is expected to be onboard all vessels. The potential effects of lighting on marine wildlife, particularly birds, are expected to be minimal if deck lighting is shielded and directed inward to avoid over-water lighting.

Although lights associated with the offshore oil platforms off southern California do appear to attract seabirds, it is not known whether or to what extent such attraction disrupts migration or foraging behavior. Specifically, although the Point Arguello platforms have been operating for 20 years or longer, there has been no indication that platform lighting has significantly affected any seabird species.

Artificial night lighting on the platforms and project vessels could potentially have an adverse effect on individual sea birds and potentially on populations of several sensitive bird species including the Marbled Murrelet, and State-designated threatened Scripps's Murrelet, and Guadalupe Murrelet. These species are all known to occur in the vicinity of the project area during both the breeding and non-breeding seasons, and are nocturnal foragers known to be attracted to artificial lighting.

4.2 Noise Effects

Birds

Noise created from transiting vessels, helicopters, and other operation-related activities including the eventual decommissioning of the platforms may exceed the threshold of potential effect for most birds, resulting in the potential for a flight response. Known data on sound-only flushes are available in Thiessen and Shaw (1957), Awbrey and Bowles (1990), Brown (1990), and Delaney et al. (1999).

Vessel and helicopter noise at a specific location is transitory; slowly increasing as a vessel approaches, and decreasing as it passes. Because of the transitory nature of this noise and the mobility of marine birds it is unlikely that a marine bird would suffer an injury or death from vessel and helicopter noise. In addition, it is expected that the visual presence of the vessels and helicopters will elicit a response from birds in the area before noise does (USFWS 2006b). Typical medium to large construction equipment (crane, large pumps, and generators) used throughout the offshore facilities would emit approximately 73 to 84 dB at 50 feet, which is near the 90 dB level that resource agencies consider potentially significant for many bird species.

Noise sources associated with the proposed activities in the Southern California Planning Area will include equipment such as vessels, aircraft, winches, generators, cable engines, ROV equipment, jet pumps, hydraulic pile driving equipment, and equipment associated with future decommissioning activities. Noise associated with construction activities on platforms are expected to be temporary and localized and are not expected to interfere with sensitive status bird species above the water surface. Noise resulting from operation of construction equipment below surface will result in an increase in underwater noise levels and these temporary increases could result in significant sound pressure levels.

While little is known regarding the effects of underwater pile driving and other sources of noise in the water column, there is a potential for effects to diving birds from impulsive (hard) underwater sound. Generally, noise produced from activities associated with pile driving might impact only those offshore species of birds that spend large quantities of time underwater, either swimming or plunge diving while foraging for food. Offshore birds that may be classified as underwater swimmers include certain waterfowl (some diving ducks) and seabirds (loons, grebes, shearwaters, cormorants, alcids). Generally, these species are limited to waters of the inner continental shelf. Waterfowl, loons, and grebes are seasonal migrants (winter), whereas cormorants and alcids are resident species with the latter family being found in higher numbers in the winter when individuals from more northern breeding areas migrate south to the Southern California Planning Area.

Monitoring of Marbled Murrelets during pile driving indicates that birds may come within the range of harmful effects of pile driving activity. The range of effects includes physical injury in the form of sublethal injuries, lethal injuries, and auditory effects, as well as non-physical behavioral effects. There is a continuum of injurious effects ranging from injury through death. The USFWS expects that onset of injury is indicated by loss of inner ear hair cells because these effects are the ones that are brought on with the least amount of sound exposure. Currently there are dual criteria for injury identified by the USFWS: 206 dB re 1μPa (peak) and 183 dB re 1μPa2-sec cumulative sound exposure level (SEL). The peak sound pressure level is the instantaneous maximum overpressure or underpressure observed during an event and the sound exposure level (SEL) is the time-integrated sound pressure squared, expressed in dB re 1µPa2-sec.

Using this as a proxy for Marbled Murrelets, other alcids (e.g., Scripps's Murrelets), and other diving and plunge diving species in the Southern California Planning Area, it is anticipated that few if any diving birds will be injured by pile driving. With anticipated maximum hammer energy of 90 kJ, the corresponding maximum sound pressure throughout the water column is estimated at 202 dB_{RMS} at 1 m from a conductor pipe. For piling driving projects in Washington State, this sound was modeled to attenuate to 190dB_{RMS} at 3.5 m from the pipe, 180dB_{RMS} at 10 m from the pipe and 160dB_{RMS} at 325 m from the pipe (Bakeman et al. 2013). As a result, underwater noise thresholds that could cause an injury to a diving bird will likely only be achieved directly next to the equipment. If sound levels are ramped up gradually, it is anticipated that most birds will leave the project area before underwater noise pressures reach the injury thresholds. In addition, the distance from shore, water depths at the platforms and the ongoing industrial activities are likely to result in fewer diving birds in the vicinity of the platforms. Future platform decommissioning activities may involve underwater explosives that could create noise levels similar to those created by pile driving, but specifics of decommissioning activities have not been identified.

Airborne noise could also affect bird species in the project vicinity. Birds on the water surface, perched on the platform or flying in the vicinity of the platform could be exposed to airborne sounds associated with pile driving that have the potential to cause harassment, depending on their distance from pile-driving activities. If noise levels reach certain thresholds, it is expected that most birds will leave the area before any injury occurs. Based on an analysis conducted by the U.S. Fish and Wildlife Service that assessed the potential for noise effects to Marbled Murrelets in terrestrial habitats, virtually all birds (any species) are harassed by sounds at a level of 82db and are flushed by sounds ≥92dB. In addition, sounds 15dB above the ambient background have been defined as a minimum sound threshold that could result in harassment to birds. A 15 dB increase represents a 34-fold increase of sound energy, and is interpreted by humans as roughly "three times as loud."

In addition to equipment, vessel traffic from the support vessels and crew boats will increase noise levels during project activities. Noise created from transiting vessels may exceed the threshold of potential effect for most birds, resulting in the potential for a flight response. Vessel noise at a specific location is transitory; slowly increasing as a vessel approaches, and decreasing as it passes. Because of the transitory nature of this noise and the mobility of marine birds it is unlikely that a marine bird would suffer an injury or death from vessel noise. In addition, it is expected that the visual presence of the vessels will elicit a response from birds in the area before noise does (USFWS 2006b).

No potential project area would be near any marine bird breeding colonies where nesting birds could suffer greater noise-related effects than those foraging or transiting through any project area near the platforms. Therefore, noise impacts to listed and other special status marine bird species are not expected to be significant.

Southern Sea Otters

Although no direct information is available on the potential impacts of exploratory and development drilling operations on southern sea otters, Riedman (1983; 1984) did observe sea otter behavior during underwater playbacks of drillship, semi-submersible, and production platform sounds and reported no changes in behavior or use of the area. Most of the otters observed by Riedman (1983) were at least 400 m from the projector; all observed by Riedman (1984) were at least 1.2 km away. Although sea otters at the surface were probably receiving little or no underwater noise, some otters continued to dive and feed below the surface during the playbacks. At 1.2 km, the received sound levels of the strongest sounds were usually at least 10 dB above the ambient noise level (Malme et al. 1983; 1984). Noise generating activities associated with the proposed action would occur more than 11 km (7 mi) offshore. Southern sea otters, except for juvenile males, rarely move more than 2 km offshore (Riedman 1987; Estes and Jameson 1988; Ralls et al. 1988), and thus could be expected to be at least 9 km away from the nearest noise generating activity. Because of this distance and the evidence from the playback experiments described above, no effects on southern sea otters from these activities are expected. In addition, southern sea otters are a near shore species; therefore, they are not expected to occur in the direct vicinity of the platforms where drilling and pile driving activities may occur.

No systematic studies have been made of the reaction of sea otters to aircraft and helicopters (Richardson et al. 1995). During aerial surveys of the southern sea otter range conducted at an altitude of about 90 m (Bonnell et al. 1983), no reactions to the two-engine survey aircraft were - observed. The helicopter trips supporting the Southern California Planning Area will all be out of the Santa Barbara, Lompoc, and Santa Maria airports and are expected to pass to the south of the main southern sea otter range. Helicopter traffic is not expected to affect southern sea otters.

Although southern sea otters will often allow close approaches by boats, they will sometimes avoid heavily disturbed areas (Richardson et al. 1995). Garshelis and Garshelis (1984) reported that sea otters in southern Alaska tend to avoid areas with frequent boat traffic, but will reoccupy those areas in seasons with less traffic. The vessel traffic corridors through the Southern California Planning Area generally pass 4 km or more offshore. No effects on southern sea otters from service vessel traffic are expected.

4.3 Produced Water and Effluent Discharges

Produced water, including those containing well stimulation fluid constituents, can be disposed of through reinjection to a reservoir or through permitted discharge to the ocean after treatment. Reinjected waste fluids will not come in into contact with aquatic biota and is not expected to affect marine and coastal wildlife. Therefore, the primary effects to marine and coastal wildlife is the permitted platform discharge of produced water containing well stimulation fluids. Well stimulation fluids can contain biocides, acids, salts, hydrocarbon solvents, and surfactants, and potential effects from their discharge could include exposure to toxic levels of well stimulation chemicals through direct contact or from ingestion of contaminated food. Similarly, matrix acidizing well stimulations may release acids and ammonium compounds, which can be toxic to benthic organisms at high enough doses. However, compliance with the requirements of NPDES General Permit CAG280000 will greatly limit the potential for exposure of marine mammals to toxic concentrations of the well stimulation-related chemicals. Because well stimulation fluids are rapidly diluted in the open ocean, marine wildlife would be expected to experience only very low levels of exposure from the water column. Acids used by some well stimulation treatments undergo chemical reactions downhole and form non-acidic components in the flowback fluids. The acids are also water soluble, so any unreacted acid will be diluted by produced water in the flowback fluids and neutralized by natural seawater buffering following discharge. Thus, well stimulation-related chemicals, including any unreacted acids, are expected to have a negligible impact on marine wildlife.

Marine mammals and birds may be indirectly affected if discharges containing well stimulation-related chemicals reduce the abundance of prey species. However, because of the rapid dilution that would occur following permitted discharge, potential impacts on prey populations would be limited in extent and would not be expected to affect overall prey abundance. Thus, food chain uptake is not expected to be a major exposure pathway for marine mammals and birds at offshore facilities where well stimulation treatments are used. As discussed, well stimulation treatments are not expected to cause either an acute or a chronic effect on benthic organisms and fish species. Therefore, well stimulation treatments are not expected to affect the prey base for marine mammals and birds.

The EPA (2013), in its issuance of the final NPDES General Permit CAG280000 for discharges from offshore oil and gas facilities located in Federal waters off the coast of southern California, provided an analysis of the potential effects of regulated discharges on several federally listed marine mammal and bird species. The analysis concluded that no effects are anticipated for the listed marine mammals and birds, primarily because of the very limited time any individuals may spend near a platform.

Among the variety of habitats they are found in, adult California red-legged frogs inhabit brackish coastal lagoons formed seasonally behind sand berms that close the mouths of rivers and streams along the central coast of California. The California red-legged frog also breeds in lagoons where salinity and water temperature levels are within suitable levels for egg and tadpole development. Storms or tides may breach these natural berms, at which point the frogs move upstream to freshwater. Due to NPDES discharge permit requirements and the rapid dilution of the discharges, contaminants from effluent discharges associated with OCS activities including well stimulation-related discharges should not be measurable in the coastal waters and sediments that enter these lagoons. Thus, California red-legged frogs are not likely to be adversely affected by effluent discharges.

Tidewater gobies are found in shallow coastal lagoons, stream mouths, and shallow areas of bays. Due to NPDES discharge permit requirements and the rapid dilution of the discharges from releases near the platforms, contaminants from effluent discharges associated with OCS activities including well stimulation-related discharges should not be measurable in the coastal waters and sediments that enter these lagoons. Thus, tidewater gobies are not likely to be adversely affected by effluent discharges.

A variety of accidents could occur during use of well stimulation treatments on the OCS that could potentially affect marine wildlife. These are associated primarily with accidental releases of well stimulation treatment chemicals and fluids, and crude oil. Impacts from an accident depend on the magnitude, frequency, location, and timing of the accident; characteristics of the spilled material; spill-response capabilities and timing; and various meteorological and hydrological factors. Impacts could include decreased health, reproductive fitness, and longevity; increased vulnerability to disease; and increased mortality. A spill could also lead to the localized reduction, disappearance, or contamination of prey species. Most accidental releases limited to well stimulation treatment - related chemicals and produced water would quickly dissipate and would only affect a small amount of habitat and relatively few individuals and only for a short time after the release.

An accident at a platform or a vessel could result in the release of well stimulation treatment chemicals to the ocean surface. Although some well stimulation treatment constituents such as acids or biocides are toxic, a surface spill during shipping of well stimulation treatment chemicals by service vessel or during offloading to a platform is expected to have minimal impact because it is not likely that the entire contents of a shipping container would spill, and because of dilution from seawater in the area of a spill. Impacts from the release of well stimulation treatment constituents from a produced water pipeline would also be minimal due to the rapid dilution that would occur. Any impacts on marine and coastal birds would be temporary, localized, and affect few if any individuals. However, species such as gulls and shearwaters, which are attracted to offshore platforms or often follow vessels, may be more likely to be exposed to an accidental release. These birds may be directly exposed while feeding or resting in spills originating from platforms or service vessels and could incur lethal or sublethal effects.

An accident from a seafloor surface expression from a fracturing well stimulation treatment (which is not reasonably foreseeable for any well stimulation treatment and not a risk in matrix acidizing) would result in only a small release of well stimulation treatment fluids and hydrocarbons. Surface expression would be localized and quickly diluted; therefore, impacts on marine willdife would be negligible. Marine wildlife that may otherwise be unaffected by an accidental release may be impacted by increased vessel traffic and remediation activities. Vessel noise and other factors related to increased human presence would likely cause changes in marine wildlife behavior and/or distribution.

4.4 Oil Spills

Oil Spill Risk Assessment

For the purposes of this ESA Section 7 consultation request, BOEM does not consider oil spills to be a *direct* effect of the action, given they are neither authorized nor intended to occur. BOEM does, however, concur that certain smaller oil spills (50 bbl or less) could be an *indirect* effect of the action, as defined under ESA regulations, given they are caused by the proposed action and are later in time, but still are reasonably certain to occur. This biological assessment therefore provides scenario and other information related to smaller accidental oil spills in Appendix A.

In the case of low-probability catastrophic spills, such as the 2010 Deepwater Horizon blowout and oil spill in the Gulf of Mexico, BOEM does not consider this category of spill to be an effect of the action, as defined under the ESA implementing regulations at 50 CFR §402.02, given (1) it is not an anticipated result of the proposed action and (2) it is not reasonably certain to occur since Pacific Outer Continental Shelf Region (POCSR) fields are mature and the majority of reservoirs have low to no pressure which require artificial lift to access the oil.

In the course of normal, day-to-day platform operations, small accidental discharges of hydrocarbons may be reasonably foreseeable. The largest oil spill in the POCSR occurred in 1969, when a loss of well control occurred on *Platform A*, offshore Santa Barbara, California which spilled an estimated 80,000 barrels (bbl) into the Santa Barbara Channel (Van Horn et al. 1988). The largest oil spill in the POCSR since 1969 was the 164 bbl *Platform Irene* pipeline spill in September 1997. Since 1969, a cumulative total of 919 barrels over a 44-year period has been spilled (Appendix A, Table A-1; TIMS spill volume report run December 29, 2014). Of the 48 oil spills greater than one bbl in the POCSR (1970-2014), only five measured 50 bbl or more in volume (Appendix A, Table A-1) The average oil spill size in the POCSR for all years is 57 bbl (1963-2014). In the "50 to less than 1,000 bbl" spill range the average oil spill size is 103 bbl. In the "1-50 bbl" range the average oil spill size is 7.11 bbl. [5] As shown in Appendix 1,

[5] From 1996 to 2010, the overall OCS average spill size in the size range of "50 to less than 1,000 bbl" is 186 bbl (Anderson et al., 2012).

Table A-1, 3.4% (49 of 1435) of the total recorded spills between 1970 and 2014 were greater than one bbl, spilling 827.7 bbl of oil into the ocean.

Given these data, the analysis presented in Appendix A, and the experience in the Pacific Region over the last 40 years, BOEM estimates the maximum most likely spill volume for the Pacific Region is 200 bbl.

Operators must report any spill that is 1 bbl or greater in the Southern California Planning Area. The development of more stringent regulations, implementation of rigorous inspection programs, imposition of civil and criminal penalties, and changes in equipment and procedures have all contributed to a safer work environment. Most recently, BSEE has promulgated regulations that require offshore operators to develop safety and environmental management systems which are intended to foster a corporate culture of environmentally responsible and safe working conditions.

The current knowledge of the geology and understanding of reservoir characteristics in the Southern California Planning Area is well advanced. Drilling techniques and equipment have improved and drilling into these mature fields is generally considered to be low risk. The Southern California Planning Area has experienced significant changes in the status of the oil and gas fields being developed and produced. Reservoir pressures have dropped to near zero in the majority of the fields now in production. In these cases, secondary[6] or tertiary[7] recovery methods are being used to force oil to the surface. The risk of a loss of well control (a blowout) resulting in a spill is exceedingly small under these conditions.

Table 1 Estimated mean number of spills and spill occurrence probability for the "50 to less than 1,000 bbl" size range using oil spill data from POCSR operations (1963-2011). Anticipated POCSR Production is 0.4073 Bbbl (0.292 [BSEE July 2014] + 0.0957 [Tranquillon Ridge] + 0.0035 [Electra Field] + 0.0161 [Carpinteria State] = 0.4073 Bbbl).

POCS Spill data (1963-2014)	Spill Rate (2012*)	Estimated Mean Number of spills	Probability of 1 or more spills
Spills ≥ 50 to < 1,000			
Platforms & Pipelines	4.57	1.86	84.4 %

Bbbl = billions of barrels *spill rate calculation methodology: Anderson et. al., 2012

Table 2 Estimated means and spill occurrence probabilities POCSR analyses using all US OCS Spill Data (1996-2010). Anticipated POCSR production is 0.4073 Bbbl.

US OCS Spill Data (1996-2010)	Spill Rate (2012*)	Estimated Mean Number of Spills	Probability of 1 or More Spills
Spills ≥ 50 to < 1,000			
Platforms & Pipelines	12.88	5.24	99.5%
Spills ≥ 1000			
Platforms	0.25	0.10	9.7%

[6] Secondary refers to the reinjection of water or gas produced from the reservoir in order to push oil to the surface.
[7] Tertiary refers to the addition of chemicals designed to increase oil flow within a well.

Pipelines	0.88	0.36	30.1%
Total	1.13	0.46	36.9%

Bbbl = billions of barrels. * Source: Anderson et. al., 2012

Taking into account these factors, the overall risk of an oil spill occurring has declined over time in the Southern California Planning Area. This said, other factors such as human error or equipment failure play a role in risk of an oil spill and small spills are likely to continue as long as oil is being produced.

BOEM calculated oil spill rates for the Pacific Region using oil spill data (1963-2014; Appendix A; Table A-1) and cumulative production from the Pacific Region. BOEM estimated the number of oil spills and the probability of one or more spills that could occur as a result of ongoing activities in the Southern California Planning Area in the "50 to less than 1000 bbl" size-range using Pacific Region oil spill rates. Oil spill occurrence is calculated as a function of the total amount of oil that could be economically produced in the Southern California Planning Area. We estimate, in the "50 to less than 1,000 bbl" size-range, there will be 1.86 spills with an 84.4% probability of occurrence for the remaining oil that could be economically produced from the Southern California Planning Area (Table 1).

For comparison, BOEM calculated oil spill probabilities using oil spill rates derived from all United States Outer Continental Shelf (US OCS) operations (1996-2010) and the total amount of oil that could be economically produced in the Southern California Planning Area (Anderson et. al., 2012). Using spill rates based on all US OCS Operations (1996-2010), the probability of one or more spills occurring in the Pacific Region for the "50 to less than 1,000 bbl" size range is 99.5%. The lower probability (84.4%) of spills in the "50 to less than 1,000 bbl" size range using POCSR oil spill data is reflective of the lower number of oil spills throughout POCSR production history. Using spill rates based on all US OCS operations (1996-2010), the probability of one or more spills occurring in the greater than 1,000 bbl size range is 36.9% (Appendix A, Table A-3). This is a conservative estimate based on overall US OCS operations. For the greater than 1,000 bbl size range, we did not calculate oil spill rates with only POCSR data due to the limited dataset (1 spill > 1,000 bbl occurred in 1969). A spill of this size would be an unlikely event in the POCSR since POCSR fields are mature and the majority of reservoirs have low to no pressure which requires artificial lift to access the oil.

Oil spill probability estimates are conservative given POCSR's:

- oil spill history,
- long established drilling program,
- producing from mature fields with lower pressure,
- no floating drilling rigs,
- no new platforms being installed, and
- all oil is transported via pipelines.

Oil Spill Trajectory Analysis

Oil spill trajectory modeling was conducted to determine the movement and fate of spilled oil if a spill occurred in the Southern California Planning Area from existing offshore oil and gas operations. The BOEM examined two available models: BOEM Oil Spill Risk Analysis (OSRA) and National Oceanic & Atmospheric Administration (NOAA) Office of Response & Restoration's General NOAA Operational Modeling Environment (GNOME). GNOME was developed by the Emergency Response Division (ERD) of NOAA's Office of Response and Restoration. This information can be used in conjunction with data from the oil spill risk assessment to provide perspective on the potential for exposure to spilled oil.

The OSRA model calculates numerous trajectories for hypothetical oil spills from pre-designated launch points by varying the wind and ocean current fields. Contact was evaluated in a grid encompassing the entire ocean region as well as grids located along the shoreline (Appendix A, Figure A-1; MMS 2000). Percent contact for a grid section is calculated by OSRA (e.g., Appendix A, Figures A-2 and A-3). The OSRA trajectories are volume-independent and only show where oil would travel given that a spill occurred.

The BOEM ran the GNOME model in three oceanographic regimes (see Appendix A, Section A.5). Releases were modeled for three wind directions correlated with the ocean current flow regimes. The GNOME model takes ocean currents and wind into account. The contacts displayed in Figures A-4 – A-8 are only for a limited set of meteorological conditions (Appendix A, Table A-5) and are not intended to encompass all of the wind conditions that could be present during a spill scenario. GNOME model outputs provide an overall picture of where oil may travel if an oil spill occurred from one of the launch points.

Southern California Planning Area

Six platforms were chosen as launch points because they are distributed throughout the geographic range of existing offshore operations as follows:

- *Santa Maria Basin* - Platforms Irene and Hidalgo;
- *Santa Barbara Channel* - Platforms Harmony, Hillhouse and a group in the eastern Channel (Gail, Grace, Gilda and Gina); and
- *San Pedro Bay* - Platform Elly.

Santa Maria Basin

Platform Irene. The models show that areas of the coastline from the Santa Maria River mouth to Gaviota and the northern Channel Islands were most likely to be affected by an oil spill from Platform Irene. (Appendix A, Figures A-2A-C and A-4 and A-5). The OSRA analysis for Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello and a 10-20% chance of contact at San Miguel Island (Appendix A, Figure A-2A). GNOME modeled spilled oil traveled from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR (Appendix A, Figure A-4).

Platform Hidalgo. The models estimated oil contacting land around Point Arguello and San Miguel Island. The Hidalgo OSRA analysis displays a 20-30% probability of oil contacting Point Arguello and a 10-20% chance of contact at San Miguel Island (Appendix A, Figure A-2B). The GNOME model estimates land fall around Point Conception, Santa Rosa Island and Santa Cruz Island. The GNOME model also estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay (Appendix A, Figure A-5).

Santa Barbara Channel

Platform Harmony. The models show that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by an oil spill from Platform Harmony. Platform Harmony OSRA analysis displays a

20-30% chance of oil contacting the mainland Gaviota coast and San Miguel Island and a 10-20% chance of oil contacting Santa Rosa and Santa Cruz Islands (Appendix A, Figure A-2C), while the GNOME model runs estimate oil landing as far north as Point San Luis (Appendix A, Figure A-6).

Platform Hillhouse. The OSRA model estimates a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island (Appendix A, Figure A-3A), while the GNOME estimates oil traveling as far west as Santa Barbara and Point Conception (Appendix A, Figure A-7).

Eastern Santa Barbara Channel

Platforms Grace, Gail, Gina, Gilda (modeling within a similar area). A spill modeled in OSRA from Platform Grace displays a 40-50% probability that oil will contact the east end of Anacapa Island and a 30-40% probability that it will contact the entire island. There is a 20-30% probability of contacting Port Hueneme and Santa Cruz Island and a 10-20% probability of contacting the mainland as far north as Goleta and as far south as Point Mugu (Appendix A, Figure A-3B). The GNOME model for Platform Gail estimates landfall from mainland Santa Barbara to south of Ventura Harbor in Oxnard and out to Anacapa Island (Appendix A, Figure A-8).

San Pedro Basin

Platform Elly. The OSRA model output estimates spilled oil to primarily stay within the San Pedro Bay and travel south along the mainland to Oceanside (Appendix A, Fig A-3C). The OSRA analysis for the Beta Unit, Platform Elly, displays a 40-50% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil traveling as far north as Alamitos Bay and as far south as Oceanside. No trajectory runs were conducted using GNOME because GNOME, as configured for this study, was limited to the geographic area of the Santa Barbara Channel and just north of Point Conception.

Oil Spill Response

BSEE regulations at 30 CFR Part 254 require that each OCS facility have a comprehensive Oil Spill Response Plan (OSRP). Response plans consist of an emergency response action plan and supporting information that includes an equipment inventory, contractual agreements with subcontractors and oil spill response cooperatives, worst-case discharge scenario, dispersant use plan, in-situ burning plan and details on training and drills. The Coast Guard is the lead response agency for oil spills in the coastal zone and coordinates the response using a Unified Command (UC), consisting of the affected state and the Responsible Party (i.e., the entity responsible for spilling and/or remediating the oil) in implementing the Incident Command System (ICS) if an oil spill occurs. Oil spill drills, either agency-lead or self-lead by a lessee/operator/contractor, also use the UC/ICS. California's Office of Spill Prevention and Response (OSPR) assumes the role of the State on-scene coordinator and plays a significant role in managing wildlife operations in the Southern California Planning Area as the state's Natural Resource Agency.

BSEE requires companies that operate in the OCS to have the means to respond to a worst-case discharge from their facilities. Many companies meet this requirement by becoming members of Oil Spill Removal Organizations (OSRO). Since 1970, oil companies operating in the Santa Barbara Channel and Santa Maria Basin have funded and operated a non-profit OSRO called

Clean Seas (www.cleanseas.com). Clean Seas acts as a resource to its member companies by providing an inventory of state-of-the-art oil spill response equipment, trained personnel, training and expertise in planning and executing response techniques. Clean Seas personnel and equipment are on standby, ready to respond to an oil spill, 24 hours a day.

The Marine Spill Response Corporation (MSRC) is the other U.S. Coast Guard-classified OSRO based in Long Beach (www.msrc.org). MSRC is a nation-wide OSRO with multiple responder-class oil spill response vessels and oil spill response barges. They are also equipped to respond to an oil spill 24 hours a day.

Clean Seas and MSRC are both equipped and prepared to respond to oil spill threats to sensitive shoreline areas through the detailed and up-to-date information on sensitive areas and response strategies from the Los Angeles/Long Beach Area Contingency Plan (https://www.wildlife.ca.gov/OSPR/Preparedness/LA-LB-Spill-Contingency-Plan) and the California OSPR (https://www.wildlife.ca.gov/OSPR).

All the OSROs in the Pacific Region are able to respond to oil spills using a variety of "tools in the tool box." These tools include mechanical recovery systems (e.g., booms, skimmers, storage devices, etc.), dispersants and, rarely, if ever, in-situ burning. Most oil recovery or remediation tools fall into these categories. In the event of a spill, as noted above, the US Coast Guard, California's Office of Oil Spill Prevention and Response and the Responsible Party will form the Unified Command and begin to make decisions as to how best respond to the spill in the most efficient manner, using the available tools. Dispersants and in-situ burning are used only after members of the Unified Command as well as trustee agencies are consulted. Neither of these tools have ever been used in the Pacific Region, although the OSROs are prepared to do so.

Fate and Effects of Oil

When an oil spill occurs, many factors determine whether that oil spill will cause significant, long lasting biological effects; comparatively little damage or no damage; or some intermediate degree of effect. Among these factors are the type, rate, and volume of oil spilled, geographic location, and the weather and oceanographic and meteorological conditions at the time of the spill. These parameters determine the quantity of oil that is dispersed into the water column; the degree of weathering, evaporation, and dispersion of the oil before it contacts a shoreline; the actual amount, concentration, and composition of the oil at the time of shoreline or habitat contact; and a measure of the toxicity of the oil. Additionally, the level of oil spill preparedness, rapidity of response, and the cleanup methods used can also greatly influence the overall impact levels of an oil spill.

In the event of an accidental oil spill, a slick forms and part of the slick begins evaporating while the action of breaking waves forms oil droplets that are dispersed into the water column. Oil in the Southern California Planning Area ranges from very heavy (API 12) to very light (API 39). Light oil has a rapid evaporation rate and is soluble in water. Light crude oils can lose up to 75% of their initial volume within a few days of a spill (NRC 2003). In contrast, heavy oil (API <22) has a negligible evaporation rate and solubility in water.

Depending on the weight of the oil spilled and the environmental conditions (i.e., sea state) at the time of a spill, six to 60% of oil during an oil spill would sink and be in the water column or on the seafloor in the vicinity of the spill (Arthur D. Little 1984). This is supported by a recent study of natural oil seeps at Coal Oil Point in the Santa Barbara Channel that range in depth from six to

67 meters offshore of Goleta, CA (Leifer et al. 2006) and are assumed to release 100 bbl/day (Farwell et al. 2009). The distribution of heavy oil in a surface slick in the Santa Barbara Channel is primarily influenced by surface currents and falls out of the slick over a period of 0.4 to 5 days (Leifer et al. 2006).

A 200 bbl spill could oil several kilometers of coastline. The likely result would be patches of light to heavy tarring of the intertidal zone resulting in localized effects to contacted biological communities. The recovery time for these communities would depend on the environment. Within several months, natural processes will remove the oil from the rocks and beaches in these high energy rocky coasts, while low energy lagoons and soft-sediment embayments can retain stranded oil residue for several years.

Oil in the marine environment can, in sufficient concentrations, cause adverse impacts to fishes (NRC 1985; GESAMP 1993). The effects can range from direct mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily affected, as well as intertidal communities that provide food and cover for fishes.

The field observations of an oil spill's effects on the marine environment are taken mostly from very large oil spills that have occurred throughout the world over the past three decades. There is an 84.4-percent probability 1.86 spills in the 50-1,000-bbl size range would occur in the Southern California Planning Area during the remaining production period. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. In perspective, the *Exxon Valdez* spilled about 36,000 tonnes (~270,000 bbl) of crude oil into Prince William Sound and the *Sea Empress* released 72,000 tonnes (~540,000 bbl) of crude oil off southwest Wales. The *American Trader* spilled about 416,000 gallons (~10,000 bbl) of crude oil offshore Huntington Beach, California. Most recently, in September 1997, a rupture in a 20-inch offshore pipeline emanating from Platform Irene resulted in the discharge of at least 6,846 gallons (163 bbl) of crude oil off the Santa Barbara coast. The spill resulted in the fouling of approximately 17 miles of coastline, and caused impacts to a variety of natural resources, including seabirds, sandy and gravel beach habitats, rocky intertidal shoreline habitats, and use of beaches for human recreation.

Effects on Southern Sea Otters by Oil Spills

Southern sea otters, which rely almost entirely on maintaining a layer of warm, dry air in their dense underfur as insulation against the cold, are among the most sensitive marine mammals to the effects of oil contamination (Kooyman et al. 1977; Geraci and St. Aubin 1980; Geraci and Williams 1990; Williams and Davis, 1995). Even a partial fouling of a sea otter's fur, equivalent to about 30 percent of the total body surface, can result in death (Kooyman and Costa 1979). This was clearly demonstrated by the *Exxon Valdez* oil spill (Davis 1990; Ballachey et al. 1994; Lipscomb et al. 1994). Earlier experimental studies had indicated that sea otters would not avoid oil (Barabash-Nikiforov 1947; Kenyon 1969; Williams 1978; Siniff et al. 1982), and many sea otters were fouled by oil during the Alaskan spill. Approximately 360 oiled sea otters were captured and taken to treatment centers over a 4-month period, and more than 1,000 dead sea otters were recovered (Geraci and Williams 1990; Zimmerman et al. 1994). Ballachey et al. (1994) concluded that several thousand sea otters died within months of the spill, and that there was evidence of chronic effects occurring for at least 3 years.

The critical factors involved in sea otter mortality in Alaska, as identified by Williams (1990), were: 1) hypothermia, directly due to the decrease in insulation resulting from fouling of the pelage; 2) pulmonary emphysema, which was thought to be due to the inhalation of toxic fumes and was more or less limited to the first 2 weeks; 3) hypoglycemia, which was possibly due to poor gastrointestinal function; and 4) lesions in other organs (liver, heart, spleen, kidney, brain), which were probably due to ingestion of oil, as well as to stress. Williams felt that stress due to the effects of captivity contributed to tissue damage in otters brought into the treatment centers for cleaning, and that pulmonary emphysema was probably the most serious problem, since it was untreatable.

Potential indirect effects on southern sea otters resulting from an oil spill include a reduction in available food resources due to mortality or unpalatability of prey organisms and the loss of appropriate habitat available to sea otters as kelp forest communities become contaminated (Riedman 1987).

The most likely oil spill scenario for the Southern California Planning Area, based on OCS spill data for California, is that 1.86 spills of a volume ranging between 50 and 1,000 bbl has an 84.4% probability of occurrence during the life of the project (Section 4.4). Based on the distribution of past spill sizes, it is estimated that such spills probably would be less than 200 bbl in volume. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the mainland or island coasts. However, the probability that an oil spill of equal to or greater than 1,000 bbl would occur also exists.

Within the Southern California Planning Area, southern sea otters are regularly found along the entire coast of San Luis Obispo County, along the Santa Barbara County coast line from the Santa Maria River mouth to Gaviota, and around San Nicolas Island. Areas within the modeled oil spill trajectories with higher densities of sea otters include the San Luis Bay vicinity (approx. 3.5-10 otters/500 m of shoreline) and either side of Point Conception (2.3-3.5 otters/500 m of shoreline). All of the models agree that areas of the coastline from the Santa Maria River mouth to Gaviota and the northern Channel Islands were most likely to be affected by an oil spill from Platform Irene. The OSRA analysis for Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at the Guadalupe-Nipomo Dunes NWR.

The OSRA analysis of a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello. The 1984 model and GNOME models also estimate land fall around Point Conception, Santa Rosa Island and Santa Cruz Island. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by an oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast and San Miguel Island.

The OSRA model of a hypothetical spill from Platform Hillhouse projects a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island. GNOME models oil traveling as far west as Santa Barbara and Point Conception.

Thus, there is a reasonable chance that a spill of less than 200 bbls in size would contact the shoreline at the southern end of the present southern sea otter range from San Luis Bay to Goleta and a lower probability of oil contacting San Nicolas Island. Predicting the length of coastline affected by an oil spill that comes ashore is extremely difficult due to the complexity of the process, which depends on factors such as nearshore wind patterns and currents, coastal bathymetry, tidal movements, and turbulent flow processes. There is a reasonable probability of southern sea otter contacts occurring as a result of a spill within the Southern California Planning Area.

Ford and Bonnell (1995), in their analysis of the potential impacts of an *Exxon Valdez*-sized spill on the southern sea otter, concluded that oil spills occurring at the southern end of the otter range present the smallest risk to the population. However, since 1995, southern sea otter range expansion to the south has continued. During annual spring surveys conducted since 1983, the population of southern sea otters between Cayucos and Gaviota has grown from a total a total of 117 otters in 1983 to 800 individuals in 2016 (Tinker and Hatfield 2016). While annual numbers have fluctuated over this time, the most recent 5-year mean of otters for that region is 701 individuals. This southern portion of the range comprises approximately 23 percent of the total 2016 population of 3,511 (Tinker and Hatfield 2016).

If a spill were to occur, the magnitude of expected southern sea otter mortality would vary with a number of factors, including the time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of the spill from shore, volume of oil contacting the shoreline, condition of the oil contacting the shoreline, the success of containment operations, number of animals contacted, and the effectiveness of otter cleaning and rehabilitation.

In its Final Revised Recovery Plan for the Southern Sea Otter (USFWS 2003), the USFWS makes the assumption that, lacking reliable data on the survivability of oiled sea otters in the wild, all sea otters coming into contact with oil within 21 days of a spill will die. The USFWS recognizes that activation of the California Department of Fish and Game's wildlife care facilities and oil spill response protocols would mitigate these impacts to some extent and that this assumption is probably conservative. Rapid and effective oil spill cleanup response would also lessen impacts on sea otters in the spill area. Nevertheless, it is expected that 1.86 spills of a volume ranging between 50 and 1,000 bbl will occur in the Southern California Planning Area during the remaining production period, and it is estimated that these spills will likely be less than 200 bbls in size. Given the likelihood a spill making landfall along the mainland coast, there is a reasonable probability of sea otter contacts occurring as a result of a spill. Although the seasonal nature of sea otter occurrence in the area and the oil spill prevention and response capabilities in place, may act to reduce the number of affected otters, due to the increasing number of sea otters expanding into the project area, moderate impacts to the southern sea otter within the Southern California Planning Area are expected, including mortality of animals.

Oil spills associated with the Southern California Planning Area are likely to result in low to moderate impacts to the southern sea otter, including limited mortality. Impacts to sea otters would be most likely to occur from a rupture of a pipeline, and could affect sea otters in the area from San Luis Bay to Gaviota. These impacts would be more severe if a spill occurred during spring months when seasonal migration brings large rafts of (predominately male) sea otters to the southern extent of their current range, off Point Conception. Additionally, if southward range expansion by the southern sea otter continues, increasing numbers of otters will be expected to occur east of Point Conception to Gaviota that could be affected in the event of an oil spill.

Effects on Birds by Oil Spills

Oil spills pose a significant threat to marine and shore birds. The effects of oil on seabirds have been extensively reviewed (e.g., Bourne 1976; Fry 1987; Leighton 1995; Burger and Fry 1983). Because of the migratory nature of many bird species in the region, the significance of any impacts from a spill will depend on the habitats affected, the time of year, species present, and the numbers of birds in the area at the time of the spill.

The immediate danger of oil to most birds is to clog or mat the fine structure of the feathers that are responsible for maintaining water repellency and heat insulation. Oiled birds are subject to hypothermia, loss of buoyancy, impaired ability to fly, and reduction in foraging ability. In addition to coating by oil, birds are also subject to chronic, long-term effects from oil that remains in the environment (Laffon et al. 2006; Alonso-Alvarez and Ferrer 2001). Small amounts of oil on a bird's plumage that were transferred to eggs during incubation have been shown to kill developing embryos (Albers 1978; Szaro et al. 1978). Birds can also accumulate oil in their diet and through preening. Holmes and Cronshaw (1977) and Brown (1982) have reviewed physiological stresses that can result from ingestion. An oil spill that affects important bird habitats (e.g., coastal marshes, intertidal foraging areas), even during periods of low use, may pose long-lasting problems. Birds have been observed to leave an area that has been affected by a spill (Hope et al. 1978; Chapman 1981; Albers, 1984). Albers (1984) suggests that such movements would cause severe impacts during the breeding season.

The endangered Light-footed Ridgway's Rail and California Least Tern, the threatened Western Snowy Plover and its designated critical habitat, and the threatened Marbled Murrelet are all present in the Southern California Planning Area during certain times of year and may suffer mortality or other adverse effects in the event of an oil spill.

Light-footed Ridgway's Rail

Light-footed Ridgway's Rails are at risk from an oil spill because they are confined to coastal salt marshes that could be contacted by oil. Individual rails, their eggs, and their nesting and sheltering habitat could suffer the effects of oiling. The oil spill cleanup process, if not conducted in accordance with federal and state regulations, could exacerbate the effects of an oil spill on the Light-footed Ridgway's Rail's habitat.

The Light-footed Ridgway's Rail population has remained relatively small and stable for many years. This taxa is also limited to only a very few marshes, and this, combined with their low population, makes them more vulnerable to an oil spill. For the reasons listed in Section 4.4, there is a 84.4-percent probability 1.86 spills in the 50-1,000-bbl size range would occur in the Southern California Planning Area during the remaining production period. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. An oil spill >1,000-bbl is unlikely in the Southern California Planning Area.

Within the areas modeled in the spill analysis, there are marshes occupied by Light-footed Ridgway's Rails at the Carpinteria Salt Marsh, Mugu Lagoon, Seal Beach, and Newport Back Bay. The populations at the Carpinteria Salt Marsh and Mugu Lagoon are small, but the populations at Seal Beach and Upper Newport Bay are among the largest in California. Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the Santa Barbara Channel from Platform Hillhouse has a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura. A spill of this prediction could impact any birds occurring in the Carpinteria Salt Marsh if oil was to get in the marsh, although the likelihood of impacts there are low because no Light-footed Ridgway's Rails have been detected there since 2011.

Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the eastern Santa Barbara Channel from Platform Grace has a 10-20% probability of oil contacting the mainland as far south as Point Mugu. If oil was transported into Mugu Lagoon through tidal action, there is a potential that Light-footed Ridgway's Rails there could be adversely affected. With the numbers of Light-footed Ridgway's Rails increasing there in recent years, individuals have spread out and occupied new areas within the marsh including several areas closer to the mouth of the lagoon (Zembal et al. 2006; Pereksta pers. obs. 2015). This increases the possibility of adverse effects occurring if oil made it into the lagoon.

Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the San Pedro Basin from Platform Elly has a 40-50% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil travelling as far north as Alamitos Bay and as far south as Oceanside. This area has several marshes occupied by Light-footed Ridgway's Rails including the Seal Beach NWR, Bolsa Chica wetlands, Huntington Beach wetlands, and Upper Newport Bay. The populations at the Seal Beach NWR and Upper Newport Bay are two of the three largest in California. If oil from a spill made it into these coastal wetlands, it could have adverse effects on Light-footed Ridgway's Rails. This taxa is resident so spills at any season could have effects, although a spill during the breeding season (March-August) has the potential to affect more sensitive life stages including eggs and chicks.

Although, a large (>1,000-bbl) oil spill from platforms with the Southern California Planning area is unlikely, based on the distribution of past spill sizes, it is estimated that a spill from the Southern California Planning area would probably be less than 200 bbl in volume (see Section 4.4). If a spill of about 200 bbl were to occur and contact any of the salt marshes identified above, impacts to Light-footed Ridgway's Rails could occur. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the wetlands. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. The nature of the identified wetlands provides opportunities for protecting the areas occupied by the Light-footed Ridgway's Rail. A greater than 1,000-bbl spill is not expected (see Section 4.4), but if one were to occur and reach wetlands occupied by the taxa, containment measures might not be able to prevent some impacts to this taxa.

The salt marshes occupied by Light-footed Ridgway's Rails are more easily protected than the open coast, which reduces the chance that Light-footed Ridgway's Rails could be affected by an offshore oil spill. Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the low likelihood that impacts to an occupied salt marsh would occur, and the oil spill prevention and response capabilities in place, impacts to Light-footed Ridgway's Rails from the proposed project are expected to be minor.

California Least Tern

The California Least Tern is highly susceptible to oiling because they nest and roost on beaches and mud flats that may be contacted by an oil spill or are in close proximity to the ocean or an estuary. They can experience direct mortality from oiling of birds and eggs, and could also experience loss of prey availability due to contamination. They could also be exposed directly to oil if they were feeding in waters affected by a spill because they dive into the water to catch their fish prey. Lastly, the California Least Tern would be adversely affected if cleanup activities were to occur on nesting beaches.

The most likely oil spill scenario for the Southern California Planning Area, based on OCS spill data for California, is that 1.86 spills of a volume ranging between 50 and 1,000 bbl has an 84.4% probability of occurrence during the life of the project (Section 4.4). Based on the distribution of past spill sizes, it is estimated that such spills probably would be less than 200 bbl in volume. The level of impact would depend on the size and timing of the spill, the success of containment efforts, and the length of time for the spill to reach the mainland coast. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. If an oil spill were to occur within the Southern California Planning Area, there is a probability of oil contacting California Least Tern breeding colonies when the terns are present in California during their breeding season.

California Least Terns breed along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties from Oceano Dunes in San Luis Obispo County to the Tijuana River Estuary in San Diego County. There are 18 breeding localities that are in or directly adjacent to the areas modeled as being impacted by oil spills in the Southern California Planning Area. Based on oil spill models, hypothetical spills from Pacific OCS platforms in the Santa Maria Basin, the Santa Barbara Channel, east Santa Barbara Channel, and San Pedro Basin have the potential to come ashore in areas where California Least Terns are nesting or roosting.

The OSRA analysis for a hypothetical spill from Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR. California Least Terns are known to nest within this region at the Oceano Dunes State Vehicular Recreation Area (SVRA), Rancho Guadalupe Dunes, and Vandenberg Air Force Base.

The OSRA analysis for a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello. The 1984 model and GNOME models also estimate land fall around Point Conception. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay. California Least Terns are known to nest within this region at the Oceano Dunes SVRA, Rancho Guadalupe Dunes, and Vandenberg Air Force Base.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by an oil spill if it should occur from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast. California Least Terns are known to nest within this region at the Oceano Dunes SVRA, Rancho Guadalupe Dunes, and Vandenberg Air Force Base.

The OSRA model of a hypothetical spill from Platform Hillhouse shows a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward

Anacapa Island (Figure 2A). GNOME models oil traveling as far west as Santa Barbara and Point Conception (Figure 6). California Least Terns are known to nest within this region at the Coal Oil Point, the Santa Clara River mouth, and Hollywood Beach.

The GNOME model of a hypothetical spill from Platform Gail estimates landfall from mainland Santa Barbara to south of Ventura Harbor in Oxnard and out to Anacapa Island. There is a 20-30% probability of oil contacting Port Hueneme and a 10-20% probability of oil contacting the mainland as far north as Goleta and as far south as Point Mugu. California Least Terns are known to nest within this region at the Coal Oil Point, the Santa Clara River mouth, Hollywood Beach, Ormond Beach, and Point Mugu.

The OSRA model of a hypothetical spill from Platform Elly estimates spilled oil to primarily stay within the San Pedro Bay and travel south along the mainland to Oceanside. The OSRA analysis for the Beta Unit, Platform Elly, displays a 40-50% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil traveling as far north as Alamitos Bay and as far south as Oceanside. No trajectory runs were conducted using GNOME because GNOME, as configured for this study, was limited to the geographic area of the Santa Barbara Channel and just north of Point Conception. California Least Terns are known to nest within this region at the LA Harbor, Seal Beach NWR, Bolsa Chica Ecological Reserve, Huntington State Beach, the Burris Basin, Upper Newport Bay, Camp Pendleton, and Batiquitos Lagoon.

If a spill of about 200 bbl were to occur during the spring or summer and contact the shoreline where California Least Terns are breeding, impacts to terns could occur, including some mortality. The severity of these impacts would depend on the size of the spill, the length of shoreline contacted, and the number of terns present in the area. A minimum of 2,451 pairs and a maximum of 3,324 pairs produced 3,432 nests in 2015 in the regions that could be affected by oil spills in the Southern California Planning Area. This is 62% of the breeding effort within California (Frost 2015).

Western Snowy Plover

The Pacific Coast population of the Western Snowy Plover is vulnerable to oil spills. Western Snowy Plovers forage along the shoreline and in sea wrack (seaweed and other natural wave-cast organic debris) at the high-tide line and are thus at risk of direct exposure to oil during spills. They can experience direct mortality from oiling of birds and eggs, and could also experience loss of prey availability due to contamination. The Western Snowy Plover could also be adversely affected if cleanup activities were to occur on nesting or wintering beaches.

The Western Snowy Plover population has been declining almost since surveys for the taxa were first conducted. Their small population and sandy beach habitat make snowy plovers more vulnerable to an oil spill. The most likely oil spill scenario for the Southern California Planning Area, based on OCS spill data for California, is that 1.86 spills of a volume ranging between 50 and 1,000 bbl has an 84.4% probability of occurrence during the life of the project (Section 4.4). Based on the distribution of past spill sizes, it is estimated that such spills probably would be less than 200 bbl in volume. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the mainland coast. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. If an oil spill were to occur within the Southern California Planning Area, there is a probability of oil contacting Western Snowy Plover breeding and wintering areas, and areas designated as critical habitat.

Western Snowy Plovers breed and winter along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties from Arroyo Laguna Creek in San Luis Obispo County to the Tijuana River Estuary in San Diego County. There are 21 recent breeding localities, 47 wintering localities, and 21 designated critical habitat units that are in or directly adjacent to the areas modeled as being impacted by oil spills in the Southern California Planning Area. Based on oil spill models, spills from Platforms in the Santa Maria Basin, the Santa Barbara Channel, east Santa Barbara Channel, and San Pedro Basin have the potential to come ashore in areas where Western Snowy Plovers are breeding or wintering.

The OSRA analysis of a hypothetical spill from Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello and a 10-20% chance of contact at San Miguel Island. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR. This area contains 8 Western Snowy Plover breeding sites, 10 wintering sites, and 1 critical habitat unit.

The OSRA analysis of a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello and a 10-20% chance of contact at San Miguel Island. The 1984 model and GNOME models also estimate land fall around Point Conception, Santa Rosa Island and Santa Cruz Island. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay. This area contains 9 Western Snowy Plover breeding sites, 12 wintering sites, and 2 critical habitat units.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by a hypothetical oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast and San Miguel Island and a 10-20% chance of oil contacting Santa Rosa and Santa Cruz Islands. This area contains 4 Western Snowy Plover breeding sites, 9 wintering sites, and 3 critical habitat units.

The OSRA model of a hypothetical spill from Platform Hillhouse shows a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island (Figure 2A). GNOME models oil traveling as far west as Santa Barbara and Point Conception (Figure 6). This area contains 5 Western Snowy Plover breeding sites, 9 wintering sites, and 4 critical habitat units.

The GNOME model of a hypothetical spill from Platform Gail estimates landfall from mainland Santa Barbara to south of Ventura Harbor in Oxnard and out to Anacapa Island. There is a 20-30% probability of oil contacting Port Hueneme and Santa Cruz Island, and a 10-20% probability of oil contacting the mainland as far north as Goleta and as far south as Point Mugu. This area contains 7 Western Snowy Plover breeding sites, 12 wintering sites, and 5 critical habitat units.

The OSRA model of a hypothetical spill from Platform Elly estimates spilled oil to primarily stay within the San Pedro Bay and travel south along the mainland to Oceanside. The OSRA analysis for the Beta Unit, Platform Elly, displays a 40-0% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil traveling as far north as Alamitos Bay and as far south as Oceanside. No trajectory runs were conducted using GNOME because GNOME, as configured for this study, was limited to the geographic area of the Santa Barbara Channel and just north of Point Conception. This area contains 5 Western Snowy Plover breeding sites, 12 wintering sites, and 8 critical habitat units.

If a spill of about 200 bbl were to contact the shoreline in the vicinity of nesting or wintering Western Snowy Plovers in this area, impacts to plovers and the primary constituent elements of their critical habitat could occur, including some mortality. Effects to Western Snowy Plovers could occur anywhere along the coast between Pismo Beach in San Luis Obispo County and Oceanside in San Diego County, and also on San Miguel Island, Santa Rosa Island, and Santa Cruz Island. Impacts to the nesting populations at these locations could include loss of adults, disruption of nesting activity, and abandonment of nesting beaches. The level of impact would depend on the size of the spill, the success of containment efforts, the length of time for the spill to reach the area, and the length of shoreline contacted. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. However, there is some risk of contact to the shoreline within a few days. Additionally, impacts to the Western Snowy Plover and its critical habitat could be exacerbated by beach cleanup efforts.

Marbled Murrelet

The threatened Marbled Murrelet is exceedingly vulnerable to oil spills due to its predominately at-sea existence. Mortality due to oil pollution is one of the major threats to Marbled Murrelet populations. Mortality from large spills and chronic oil pollution has been occurring for decades, but is poorly documented throughout the species range (Carter and Kuletz 1995). Marbled Murrelets have been impacted by oil pollution in Prince William Sound, central California, and western Washington (Carter and Kuletz 1995). The Exxon Valdez oil spill in Alaska caused the largest single mortality of murrelets (about 8,400 birds) in the world, most of which were Marbled Murrelets, and contributed to the decline of murrelet populations in Prince William Sound.

An uncontrolled discharge in the project area could impact Marbled Murrelets in nearshore areas, especially if it was from a platform north of Point Conception where areas along the San Luis Obispo and northern Santa Barbara Counties coastlines could be impacted. Although, given the low numbers of Marbled Murrelets observed to occur within the Southern California Planning Area and the seasonal nature of their occurrence, Marbled Murrelets would not be expected to suffer significant mortality due to a spill from the proposed project.

Marbled Murrelets visit the coasts of San Luis Obispo and northern Santa Barbara Counties during the breeding season and winter. They are occasionally seen off the south coast of Santa Barbara County and off Ventura and Los Angeles Counties; however, records here are sparse. The species occurs in areas modeled as being impacted by oil spills in the Southern California Planning Area. Based on oil spill models, spills from Platforms in the Santa Maria Basin and the Santa Barbara Channel have the potential to have at-sea impacts to Marbled Murrelets in areas where they are foraging or spending the winter.

The OSRA analysis of a hypothetical spill from Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello and a 10-20% chance of contact at San Miguel Island. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR.

The OSRA analysis of a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello and a 10-20% chance of contact at San Miguel Island. The 1984 model and GNOME models also estimate land fall around Point Conception, Santa Rosa Island and Santa Cruz Island. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by a hypothetical oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast and San Miguel Island and a 10-20% chance of oil contacting Santa Rosa and Santa Cruz Islands.

If a spill of about 200 bbl were to occur at sea in the vicinity of foraging or wintering Marbled Murrelets, impacts to the species could occur, including some mortality. Effects to Marbled Murrelets could occur anywhere along the coast between San Luis Bay and Point Conception, and possibly around the western Channel Islands. Impacts could include loss of adults and fledged juveniles. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time the spill stayed at sea. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid.

Effects on Amphibians by Oil Spills

Oil may affect amphibians through various pathways, including direct contact, ingestion of contaminated prey, and lingering sublethal impacts due to oil becoming sequestered in sediments and persisting in some cases for years in low energy environments (NRC 1985). The level of impacts and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat. Breeding habitat in coastal lagoons could be adversely affected and impacts to adults, tadpoles, and egg masses could occur.

California Red-legged Frog

Among the variety of habitats they are found in, adult California red-legged frogs inhabit brackish coastal lagoons formed seasonally behind sand berms that close the mouths of rivers and streams along the central coast of California. The California red-legged frog also breeds in lagoons where salinity and water temperature levels are within suitable levels for egg and tadpole development. Storms or tides may breach these natural berms, at which point the frogs move upstream to freshwater. There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms have been breached. California red-legged frogs cannot tolerate salinities in excess of 9 ppt and leave the coastal lagoons when seawater breaches the sand berms. Although no direct oil contact with California red-legged frogs is expected, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. If the sand berms reform and conditions become favorable, some California red-legged frogs may return before the contaminated sediments are flushed into the ocean. The level of toxicity would be dependent on the weathering of the oil and the volume of oil that reaches the lagoon. An at-sea oil spill would not impact upland habitat of California red-legged frogs, which is well upstream of the coast.

There are five critical habitat units that include coastal areas that have a boundary with the coastline in the Southern California Planning Area (SLO-2, SLO-3, STB-4, STB-5, STB-6) and include watersheds that flow into the ocean or coastal lagoons. Three of these (STB-4, STB-5 and STB-6) are in areas that could be impacted by an oil spill within the Southern California Planning Area. The physical and biological features essential to the conservation of the species (primary constituent elements) that are encompassed within these units include aquatic breeding habitat, aquatic non-breeding habitat, upland habitat, and dispersal habitat. At Jalama Creek, about 4.4 miles south of the City of Lompoc, 7,685 acres along the coast were designated, at Gaviota Creek 12,888 acres were designated, and at Arroyo Quemado to Refugio Creek 11,985 acres were designated (75 FR 12816).

The most likely oil spill scenario for the Southern California Planning Area, based on OCS spill data for California, is that 1.86 spills of a volume ranging between 50 and 1,000 bbl has an 84.4% probability of occurrence during the life of the project (Section 4.4). Based on the distribution of past spill sizes, it is estimated that such spills probably would be less than 200 bbl in volume. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the coastal lagoons. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. The nature of the identified wetlands provides opportunities for protecting the areas occupied by the California red-legged frog. A greater than 1,000-bbl spill is not expected (see Section 4.4), but if one were to occur and reach wetlands occupied by the California red-legged frog, containment measures might not be able to prevent some impacts to this taxa.

If a larger spill did occur, and the sand berms of the coastal lagoons were breached, lethal impacts to California red-legged frogs could occur if individuals were oiled before they could leave the area. Sublethal impacts might occur if the frogs returned before rains flushed the sediments from the lagoons. Oil spill response teams would be expected to boom the mouths of creeks and rivers or enhance the existing berms in the event of a spill thus minimizing the chance of oil reaching the lagoons.

California red-legged frogs are found in several coastal lagoons along the coasts of San Luis Obispo and Santa Barbara Counties south to the vicinity of Goleta, which are part of several core recovery areas for the subspecies (USFWS 2002). Tadpoles have been reported in Jalama and Cañada Honda creeks, and adult California red-legged frogs can be found seasonally in the coastal lagoons of the central California coast. Eggs and tadpoles are found in the coastal lagoons where salinity and water temperatures are suitable. Based on oil spill models, spills from Platforms in the Santa Maria Basin, and Santa Barbara Channel have the potential to come ashore in areas where coastal lagoons are occupied by California red-legged frogs. The OSRA analysis of a hypothetical spill from Platform Irene displays the highest probability (50-60%) of oil contacting land at Point Arguello. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR.

The OSRA analysis of a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello. The 1984 model and GNOME models also estimate land fall along the mainland coast around Point Conception. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County are most likely to be affected by a hypothetical oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast.

The OSRA model of a hypothetical spill from Platform Hillhouse shows a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island (Figure 2A). GNOME models oil traveling as far west as Santa Barbara and Point Conception (Figure 6).

An oil spill of about 200 bbl that contacted the mainland along the central California coast would be unlikely to result in California red-legged frog mortality or sub-lethal effects. Offshore oil transported to shore through natural wind, wave and tidal processes will not likely flow into lagoons, streams or rivers where suitable fresh water habitat for California red-legged frogs exists. However, the level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the coastal lagoons. In addition, habitat destruction could result from clean-up efforts. Proper preparation and execution of the oil spill contingency plan should protect these areas during an oil spill response. Based on this information, effects to the California red-legged frog or its critical habitat from an oil spill in the Southern California Planning Area would be expected to be minor.

Effects on Fish by Oil Spills

Research shows that hydrocarbons and other constituents of petroleum spills can, in sufficient concentrations, cause adverse impacts to fish (NRC 1985; GESAMP 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily impacted, as well as intertidal communities that provide food and cover for fishes. Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification in fish. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver. Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC 1985). Many of these sublethal effects are symptomatic of stress and may be transient and only slightly debilitating. However, all repair or recovery requires energy, and this may ultimately lead to increased vulnerability to disease or to decreased growth and reproductive success.

The egg, early embryonic, and larval-to-juvenile stages of fish seem to be the most sensitive to oil. Damage may not be realized until the fish fails to hatch, dies upon hatching, or exhibits some abnormality as a larva, such as an inability to swim (Malins and Hodgins 1981). There are several reasons for this vulnerability of early life stages. First, embryos and larvae lack the organs found in adults that can detoxify hydrocarbons. Second, most do not have sufficient mobility to avoid or escape spilled oil. Finally, the egg and larval stages of many species are concentrated at the surface of the water, where they are more likely to be exposed to the most toxic components of an oil slick.

Tidewater Goby

Tidewater gobies are found in shallow coastal lagoons, stream mouths, and shallow areas of bays. There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms blocking the stream mouths from the ocean have been breached. Breaches usually occur during the winter and spring months, and tidewater gobies often move upstream out of the lagoons during this period. Although direct oil contact with gobies would be unlikely, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. When the gobies returned, short-term sublethal effects would also be expected, since gobies burrow into and feed in the sediment and rely on macrofaunal and intertidal communities for food and shelter from predators. The level of impacts, however, would be dependent on the volume of oil that reached their habitat and the amount of weathering and mixing the oil had undergone before reaching the habitat.

The most likely oil spill scenario for the Southern California Planning Area, based on OCS spill data for California, is that 1.86 spills of a volume ranging between 50 and 1,000 bbl has an 84.4% probability of occurrence during the life of the project (Section 4.4). Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. An oil spill of this size is expected to weather, mix, and break up to the point where only limited tarring would be expected to coastal lagoons along the Southern California Planning Area. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the coastal lagoons.

If a larger spill did occur, and the sand berms of the coastal lagoons were breached, short-term sublethal effects to tidewater gobies might occur. However, oil spill response teams would be expected to boom the mouths of creeks and rivers or enhance the existing berms in the event of a spill, thus minimizing the chance of oil reaching the lagoons.

Tidewater gobies are found in a number of coastal lagoons along the coast from San Luis Obispo County to San Diego County, 34 of which are designated as critical habitat for the species from Arroyo de la Cruz in San Luis Obispo County to the San Luis Rey River in San Diego County (78 FR 8745). Based on oil spill models, hypothetical spills from Pacific OCS oil and gas platforms in the Santa Maria Basin, the Santa Barbara Channel, east Santa Barbara Channel, and San Pedro Basin have the potential to come ashore in areas where coastal lagoons are occupied by tidewater gobies.

The OSRA analysis of a hypothetical spill from Platform Irene displays the highest probability (50–60%) of oil contacting land at Point Arguello. GNOME modeled spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes NWR. Three occupied tidewater goby critical habitat units occur in the modeled area between San Luis Obispo Creek and the Santa Maria River Mouth.

The OSRA analysis of a hypothetical spill from Platform Hidalgo displays a 20-30% probability of oil contacting Point Arguello. The 1984 model and GNOME models also estimate land fall around Point Conception. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay. Three occupied tidewater goby critical habitat units occur in the modeled area between San Luis Obispo Creek and the Santa Maria River Mouth.

All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by a hypothetical oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. The Platform Harmony OSRA analysis displays a 20-30% chance of oil contacting the mainland Gaviota coast. Nine occupied tidewater goby critical habitat units occur in the modeled area between San Luis Obispo Creek and Arroyo Hondo.

The OSRA model of a hypothetical spill from Platform Hillhouse shows a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island (Figure 2A). GNOME models oil traveling as far west as Santa Barbara and Point Conception (Figure 6). Thirteen occupied tidewater goby critical habitat units occur in the modeled area between Canada de las Agujas and the Santa Clara River Mouth.

The GNOME model of a hypothetical spill from Platform Gail estimates landfall from mainland Santa Barbara to south of Ventura Harbor in Oxnard and out to Anacapa Island. There is a 20-30% probability of oil contacting Port Hueneme and a 10-20% probability of oil contacting the mainland as far north as Goleta and as far south as Point Mugu. Eight occupied tidewater goby critical habitat units occur in the modeled area between Winchester-Bell Canyon and the J Street Drain-Ormond Lagoon.

The OSRA model output for a hypothetical spill from Platform Elly estimates spilled oil to primarily stay within the San Pedro Bay and travel south along the mainland to Oceanside. The OSRA analysis for the Beta Unit, Platform Elly, displays a 40-50% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil traveling as far north as Alamitos Bay and as far south as Oceanside. No trajectory runs were conducted using GNOME because GNOME, as configured for this study, was limited to the geographic area of the Santa Barbara Channel and just north of Point Conception. Two tidewater goby critical habitat units occur in the modeled area including Aliso Creek in Orange County and the San Luis Rey River in San Diego County.

Most goby habitat will be separated from the ocean by sand berms and thus would be protected to some degree. However, tides, heavy surf, or early seasonal rains could breach these barriers. Oil spill response teams would be expected to protect these habitats further with booms and enhancement of the natural berms. During winter months, after rains and storms have breached the natural sand barriers, protection of tidewater goby habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast would in all likelihood contact and impact tidewater goby habitats, possibly resulting in some mortality and likely short-term sub-lethal effects. This would depend on the amount spilled and the weathering of the oil.

However, tidewater gobies along the south-central California coast are quite resilient and have a great ability to disperse and re-colonize areas from which they were previously eliminated. Given the moderate probability that an oil spill would contact the mainland, the oil spill prevention and response capabilities in place, and the ability of tidewater gobies to re-colonize their habitat, effects to tidewater gobies in the Southern California Planning Area are expected to be low.

Effects on Plants by Oil Spills

Plant mortality from oil spills can be caused by smothering and toxic reactions to hydrocarbon exposure, especially if oil reaches shore before much of the spill's lighter fractions have evaporated or dissolved. Generally, oiled marsh vegetation dies, but roots and rhizomes survive when oiling is not too severe (Burns and Teal 1971). Research has shown that recovery to pre-oiling conditions usually occurs within a few growing seasons, depending on the magnitude of exposure (Holt et al. 1975; Lytle 1975; Delaune et al. 1979; Alexander and Webb 1987).

Salt Marsh Bird's-Beak

The endangered salt marsh bird's-beak grows in the higher reaches of coastal salt marshes to intertidal and brackish areas influenced by freshwater input. Oil spills and oil spill clean-up operations within the Southern California Planning Area, especially within Mugu Lagoon, could have adverse effects on the salt marsh bird's-beak, particularly for seedlings. Spilled oil tends to accumulate near the high tide line, a zone of the marsh where the salt marsh bird's-beak can occur. Oil would very likely result in high mortality of the salt marsh bird's-beak seedlings and juvenile plants during years of seedling regeneration. Oil clean-up operations involving mechanical removal could also cause substantial disturbance of habitat occupied by the salt marsh bird's-beak. The direct effects of oil on mature salt marsh bird's-beak individuals are uncertain but could likely be less than those associated with its clean-up.

Historically, salt marsh bird's-beak was widespread in coastal salt marshes from Morro Bay in San Luis Obispo County to San Diego County and northern Baja California. Salt marsh bird's-beak is currently limited to a very few (<10) salt marshes along the coast of California and Baja California, Mexico, which makes this species more vulnerable to an oil spill. Within the area of coastline that could be affected by oil spills from the Southern California Planning Area, these marshes include Carpinteria Salt Marsh in Santa Barbara County, Ormond Beach and Mugu Lagoon in Ventura County, and Upper Newport Bay in Orange County.

Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the Santa Barbara Channel from Platform Hillhouse has a 30-40% probability of oil contacting mainland Santa Barbara and a 10-20% probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura. A spill of this prediction could impact any salt marsh bird's-beak plants occurring in the Carpinteria Salt Marsh if oil was to get in the marsh.

Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the eastern Santa Barbara Channel from Platform Grace has a 10-20% probability of oil contacting the mainland as far south as Point Mugu. If oil was transported into the Ormond Beach wetlands or Mugu Lagoon through tidal action, there is a potential that salt marsh bird's-beak plants there could be adversely affected. The population at Mugu Lagoon is one of the larger left in the range of the taxa so effects here could be significant.

Based on the OSRA model estimation (see Section 4.4), a hypothetical spill in the San Pedro Basin from Platform Elly has a 40-50% probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10-20% probability of oil travelling as far north as Alamitos Bay and as far south as Oceanside. Upper Newport Bay within this area is occupied by the salt marsh bird's-beak. If oil from a spill made it into these coastal wetlands, it could have adverse effects on the salt marsh bird's-beak.

Although, a large (>1,000-bbl) oil spill from platforms with the Southern California Planning area is unlikely, based on the distribution of past spill sizes, it is estimated that a spill from the Southern California Planning area would probably be less than 200 bbl in volume (see Section 4.4). If a spill of about 200 bbl were to occur and contact any of the salt marshes identified above, impacts to salt marsh bird's-beak could occur. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the wetlands. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. The nature of the identified wetlands provides opportunities for protecting the areas occupied by the salt marsh bird's-beak. A greater than 1,000-bbl spill is not expected (see Section 4.4), but if one were to occur and reach wetlands occupied by the taxa, containment measures might not be able to prevent some impacts to this taxa.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the low probability of contact with an occupied marsh, and the oil spill prevention and response capabilities in place, impacts to salt marsh bird's-beak from an oil spill within the Southern California Planning Area are expected to be minor.

5. Conclusion and Determination of Effects

In summary, this biological assessment has assessed the potential effects to federally endangered and threatened species that may result from the continued leasing, exploration, development and production of oil and gas on the United States' outer continental shelf within the Southern California Planning Area as defined by BOEM and BSEE. The following threatened and endangered species, and their critical habitat, may be affected directly or indirectly by the proposed actions:

Western Snowy Plover

The Western Snowy Plover and its critical habitat could be affected indirectly by the proposed actions if oil spills were to occur that contacted beaches occupied by the taxa, including those designated as critical habitat. Western Snowy Plovers forage along the shoreline and in sea wrack at the high-tide line and are thus at risk of direct exposure to oil during spills. They could experience direct mortality from oiling of birds and eggs, and could also experience loss of prey availability due to contamination. The Western Snowy Plover would also be adversely affected if cleanup activities were to occur on nesting or wintering beaches.

Their small population and sandy beach habitat make Western Snowy Plovers vulnerable to an oil spill. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the mainland coast. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. If an oil spill were to occur within the Southern California Planning Area, there is a probability of oil contacting Western Snowy Plover breeding and wintering areas, and areas designated as critical habitat.

If an oil spill were to contact the shoreline in the vicinity of nesting or wintering Western Snowy Plovers in this area, impacts to plovers and the primary constituent elements of their critical habitat could occur, including some mortality. The level of impact would depend on the size of the spill, the success of containment efforts, the length of time for the spill to reach the area, and the length of shoreline contacted. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. However, there is some risk of contact to the shoreline within a few days. Additionally, impacts to the Western Snowy Plover could be exacerbated by beach cleanup efforts. Therefore, we have determined that the proposed actions may affect and are likely to adversely affect the Western Snowy Plover and its critical habitat.

California Least Tern

The California Least Tern is highly susceptible to oiling because they nest and roost on beaches and mud flats that may be contacted by an oil spill or are in close proximity to the ocean or an estuary. They can experience direct mortality from oiling of birds and eggs, and could also experience loss of prey availability due to contamination. They could also be exposed directly to oil if they were feeding in waters affected by a spill because they dive into the water to catch their fish prey. Lastly, the California Least Tern would be adversely affected if cleanup activities were to occur on nesting beaches.

The level of impact would depend on the size and timing of the spill, the success of containment efforts, and the length of time for the spill to reach the mainland coast. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. If an oil spill were to occur within the Southern California Planning Area, there is a probability of oil contacting California Least Tern breeding colonies when the terns are present in California during their breeding season.

If an oil spill was to occur during the spring or summer and contact the shoreline where California Least Terns are breeding, impacts to terns could occur, including some mortality. The severity of these impacts would depend on the size of the spill, the length of shoreline contacted, and the number of terns present in the area. A minimum of 2,451 pairs and a maximum of 3,324 pairs produced 3,432 nests in 2015 in the regions that could be affected by oil spills in the Southern California Planning Area. This is 62% of the breeding effort within California. Therefore, we have determined that the proposed actions may affect and are likely to adversely affect the California Least Tern.

Light-footed Ridgway's Rail

The Light-footed Ridgway's Rail could be affected indirectly by the proposed actions if oil spills were to occur and contact any of the coastal salt marshes occupied by the taxa. They could experience direct mortality from oiling of birds and eggs, and could also experience loss of prey availability due to contamination. The oil spill cleanup process, if not conducted in accordance with federal and state regulations, could exacerbate the effects of an oil spill on the rail's habitat. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the wetlands. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. The nature of the identified wetlands provides opportunities for protecting the areas occupied by the Light-footed Ridgway's Rail. A greater than 1,000-bbl spill is not expected, but if one were to occur and reach wetlands occupied by the taxa, containment measures might not be able to prevent some impacts to this taxa.

The salt marshes occupied by Light-footed Ridgway's Rails are more easily protected than the open coast, which reduces the chance that Light-footed Ridgway's Rails could be affected by an offshore oil spill. Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, and the low likelihood that impacts to an occupied salt marsh would occur, and the oil spill prevention and response capabilities in place, impacts to Light-footed Ridgway's Rails from the proposed project are expected to be discountable. Therefore, we have determined that the proposed actions may affect, but are not likely to adversely affect the Light-footed Ridgway's Rail.

Marbled Murrelet

The Marbled Murrelet is exceedingly vulnerable to oil spills due to its predominately at-sea existence. Mortality due to oil pollution is one of the major threats to Marbled Murrelet populations. An uncontrolled discharge in the project area could impact Marbled Murrelets in nearshore areas, especially if it was from a platform north of Point Conception where areas along the San Luis Obispo and northern Santa Barbara County's coastlines could be impacted.

If an oil spill were to occur at sea in the vicinity of foraging or wintering Marbled Murrelets, impacts to the species could occur, including some mortality. Effects to Marbled Murrelets could occur anywhere along the coast between San Luis Bay and Point Conception, and possibly around the western Channel Islands. Impacts could include loss of adults and fledged juveniles. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time the spill stayed at sea.

However, given the low numbers of Marbled Murrelets observed to occur within the Southern California Planning Area and the seasonal nature of their occurrence, Marbled Murrelets would not be expected to suffer significant mortality due to a spill from the proposed project. Therefore, we have determined that oil spills may affect, but are not likely to adversely affect the Marbled Murrelet.

In addition to oil spills, Marbled Murrelets could be affected by artificial lighting and noise, especially underwater noise related to pile driving. Artificial night lighting on the platforms could potentially have an adverse effect on Marbled Murrelets as they are nocturnal foragers known to be attracted to artificial lighting. However, there is limited evidence to date of seabirds being attracted to Pacific OCS platforms or other project lighting in the area and many projects on the Pacific OCS now incorporate minimization measures to reduce effects of work vessel lighting to birds. If sound levels are ramped up gradually, it is anticipated that most birds will leave the project area before underwater noise pressures reach the injury or barotrauma thresholds. In addition, the distance from shore, water depths at the platforms and the ongoing industrial activities are likely to result in fewer Marbled Murrelets in the vicinity of the platforms. Therefore, we have determined that these elements of the proposed actions may affect, but are not likely to adversely affect the Marbled Murrelet.

Southern sea otter

Southern sea otters are highly susceptible to oil spills and are among the most sensitive marine mammals to the effects of oil contamination. Even a partial fouling of a sea otter's fur, equivalent to about 30 percent of the total body surface, can result in death. Critical factors related to oiling that can result in sea otter mortality include hypothermia, pulmonary emphysema, hypoglycemia, and lesions in other organs. In addition, stress due to the effects of captivity has contributed to tissue damage in sea otters brought into the treatment centers for cleaning. Potential indirect effects on southern sea otters resulting from an oil spill include a reduction in available food resources due to mortality or unpalatability of prey organisms and the loss of appropriate habitat available to sea otters as kelp forest communities become contaminated.

If a spill were to occur, the magnitude of expected southern sea otter mortality would vary with a number of factors, including the time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of the spill from shore, volume of oil contacting the shoreline, condition of the oil contacting the shoreline, the success of containment operations, number of animals contacted, and the effectiveness of otter cleaning and rehabilitation. Within this area, southern sea otters are regularly found along the entire coast of San Luis Obispo County, along the Santa Barbara County coast line from the Santa Maria River mouth to Gaviota, and around San Nicolas Island. Areas within the modeled oil spill trajectories with higher densities of sea otters include the San Luis Bay vicinity (approx. 3.5-10 otters/500 m of shoreline) and either side of Point Conception (2.3-3.5 otters/500 m of shoreline).

Oil spills associated with the Southern California Planning Area are likely to result in low to moderate impacts to the southern sea otter, including limited mortality. Impacts to sea otters would be most likely to occur from a rupture of a pipeline, and could affect sea otters in the area from San Luis Bay to Gaviota. These impacts would be more severe if a spill occurred during spring months when seasonal migration brings large rafts of (predominately male) sea otters to the southern extent of their current range, off Point Conception. Additionally, if southward range expansion by the southern sea otter continues, increasing numbers of otters will be expected to occur east of Point Conception to Gaviota that could be affected in the event of an oil spill. Given the likelihood a spill making landfall along the mainland coast, there is a reasonable probability of sea otter contacts occurring as a result of a spill. Although the seasonal nature of sea otter occurrence in the area and the oil spill prevention and response capabilities in place, may act to reduce the number of affected otters, due to the increasing number of sea otters expanding into the project area, moderate impacts to the southern sea otter within the Southern California Planning Area are expected, including mortality of animals. Therefore, we have determined that oil spills may affect, and are likely to adversely affect the southern sea otter.

Based on studies summarized above in Section 5, drilling activities including pile driving, aircraft and helicopter use, and vessel traffic associated with the proposed actions are not expected to have effects on southern sea otters. Therefore, we have determined that these elements of the proposed actions may affect, but are not likely to adversely affect the southern sea otter.

California red-legged frog and its critical habitat

Among the variety of habitats they are found in, adult California red-legged frogs inhabit brackish coastal lagoons formed seasonally behind sand berms that close the mouths of rivers and streams along the central coast of California. The California red-legged frog also breeds in lagoons where salinity and water temperature levels are within suitable levels for egg and tadpole development. Storms or tides may breach these natural berms, at which point the frogs move upstream to freshwater. Due to NPDES discharge permit requirements and the rapid dilution of the discharges, contaminants from effluent discharges associated with OCS activities including well stimulation-related discharges should not be measurable in the coastal waters and sediments that enter these lagoons. Thus, California red-legged frogs and their critical habitat are not likely to be adversely affected by effluent discharges.

There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms have been breached. California red-legged frogs cannot tolerate salinities in excess of 9 ppt and leave the coastal lagoons when seawater breaches the sand berms. Although no direct oil contact with California red-legged frogs is expected, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. If the sand berms reform and conditions become favorable, some California red-legged frogs may return before the contaminated sediments are flushed into the ocean. The level of toxicity would be dependent on the weathering of the oil and the volume of oil that reaches the lagoon.

An oil spill that contacted the mainland along the central California coast would be unlikely to result in California red-legged frog mortality or sub-lethal effects. Offshore oil transported to shore through natural wind, wave and tidal processes will not likely flow into lagoons, streams or rivers where suitable fresh water habitat for California red-legged frogs exists. However, the level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the coastal lagoons. In addition, habitat destruction (including effects to critical habitat) could result from clean-up efforts. Proper preparation and execution of the oil spill contingency plan should protect these areas during an oil spill response. Based on this information, effects to the California red-legged frog or its critical habitat from an oil spill in the Southern California Planning Area are expected to be minor. Therefore, we have determined that the proposed actions may affect, but are not likely to adversely affect the California red-legged frog and its critical habitat.

Tidewater goby and its critical habitat

Tidewater gobies are found in shallow coastal lagoons, stream mouths, and shallow areas of bays. Due to NPDES discharge permit requirements and the rapid dilution of the discharges, contaminants from effluent discharges associated with OCS activities including well stimulation-related discharges should not be measurable in the coastal waters and sediments that enter these lagoons. Thus, tidewater gobies are not likely to be adversely affected by effluent discharges.

There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms blocking the stream mouths from the ocean have been breached. Breaches usually occur during the winter and spring months, and tidewater gobies often move upstream out of the lagoons during this period. Although direct oil contact with gobies would be unlikely, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. When the gobies returned, short-term sublethal effects would also be expected, since gobies burrow into and feed in the sediment and rely on macrofaunal and intertidal communities for food and shelter from predators. The level of impacts, however, would be dependent on the volume of oil that reached their habitat and the amount of weathering and mixing the oil had undergone before reaching the habitat.

Most goby habitat will be separated from the ocean by sand berms and thus would be protected to some degree. However, tides, heavy surf, or early seasonal rains could breach these barriers. Oil spill response teams would be expected to protect these habitats further with booms and enhancement of the natural berms. During winter months, after rains and storms have breached the natural sand barriers, protection of tidewater goby habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast would in all likelihood contact and impact tidewater goby habitats, possibly resulting in some mortality and likely short-term sub-lethal effects. This would depend on the amount spilled and the weathering of the oil.

Given the moderate probability that an oil spill would contact the mainland, the oil spill prevention and response capabilities in place, and the ability of tidewater gobies to re-colonize their habitat, effects to tidewater gobies and their critical habitat in the Southern California Planning Area are expected to be low. Therefore, we have determined that the proposed actions may affect, but are not likely to adversely affect the tidewater goby and its critical habitat.

Salt marsh bird’s-beak

Salt marsh bird's-beak grows in the higher reaches of coastal salt marshes to intertidal and brackish areas influenced by freshwater input. Oil spills and oil spill clean-up operations within the Southern California Planning Area, especially within Mugu Lagoon, could have adverse effects on the salt marsh bird’s-beak, particularly for seedlings. Spilled oil tends to accumulate near the high tide line, a zone of the marsh where the salt marsh bird’s-beak can occur. Oil would very likely result in high mortality of the salt marsh bird’s-beak seedlings and juvenile plants during years of seedling regeneration. Oil clean-up operations involving mechanical removal could also cause substantial disturbance of habitat occupied by the salt marsh bird’s-beak. The direct effects of oil on mature salt marsh bird’s-beak individuals are uncertain but could likely be less than those associated with its clean-up.

If an oil spill were to occur and contact any of the salt marshes occupied by the taxa, impacts to salt marsh bird’s-beak could occur. The level of impact would depend on the size of the spill, the success of containment efforts, and the length of time for the spill to reach the wetlands. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. The nature of the identified wetlands provides opportunities for protecting the areas occupied by the salt marsh bird’s-beak. Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the low probability of contact with an occupied marsh, and the oil spill prevention and response capabilities in place, impacts to salt marsh bird’s-beak from an oil spill within the Southern California Planning Area are expected to be minor. Therefore, we have determined that the proposed actions may affect, but are not likely to adversely affect the salt marsh bird’s-beak.

Table 3: Summary of Determinations for USFWS ESA Listed Species

Listed Species	**Potential Impacting Factors**	**Determination for Ongoing Activities**	**Comments**
Western Snowy Plover and critical habitat	Oil Spill	Likely to Adversely Affect	LAA - Oil Spills only
California Least Tern	Oil Spill	Likely to Adversely Affect	LAA - Oil Spills only
Light-footed Ridgway's Rail	Oil Spill	Not Likely to Adversely Affect	Low probability of contact
Marbled Murrelet	Artificial Light, Noise, Oil Spill	Not Likely to Adversely Affect	Low probability of species occurrence
Southern Sea Otter	Noise, Collision, Oil Spill	Likely to Adversely Affect	LAA - Oil Spills only
California Red-legged Frog and critical habitat	Effluent Discharge, Oil Spill	Not Likely to Adversely Affect	Low probability of contact
Tidewater Goby and critical habitat	Effluent Discharge, Oil Spill	Not Likely to Adversely Affect	Low probability of contact
Salt Marsh Bird's-Beak	Oil spill	Not Likely to Adversely Affect	Low probability of contact

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Appendix A

Pacific Outer Continental Shelf Region Programmatic Oil Spill Risk Analysis

This appendix covers oil spill risk, fate of oil, trajectory analysis, and response. Also included is a technical description of current oil spill models.

A.1 Oil Spill Risk Assessment

In the course of normal, day-to-day platform operations, accidental discharges of hydrocarbons may occur. Such accidents are typically limited to discharges of quantities of less than one barrel (bbl) of crude oil. Table A-1 lists the hydrocarbon spills that occurred in the Pacific Outer Continental Shelf Region (POCSR) from 1963 through 2015. During that period, 1,450 oil spills were recorded. The total volume of oil spilled in the Pacific Region is dominated by the 1969 Santa Barbara spill. Since 1969, spills have ranged in size from less than one bbl to 164 bbl, for a total of 920 bbl and an average oil spill size of 0.64 bbl. Of the 49 oil spills greater than one bbl in the Pacific Region (1970 – 2015), five measured 50 bbl or more in volume (Table A-1); the largest of these was the 164 bbl Platform Irene pipeline spill in September 1997. If the 1969 oil spill is included (1963 – 2015) the average oil spill size is 57 bbl. The average oil spill size in the Pacific Region for oil spills in the "50 to less than 1,000 bbl" range is 103 bbl and the average oil spill size for oil spills in the 1 – 50 bbl range is 7.11 bbl. [1] As shown in Table A-1, 3.4 % of the total recorded spills between 1970 and 2015 (49 of 1450) were greater than one bbl, spilling 919.7 bbl of oil into the ocean. Given these data and the experience in the Pacific Region over the last 40 years, BOEM estimates the most likely spill volume for spills in the 50 to less than 1,000 bbl range to be less than 200 bbl.

BOEM calculated oil spill rates for the Pacific Region using oil spill data (1963 – 2015, Table A-1) and cumulative production from the Pacific Region. BOEM estimated the number of oil spills and the probability of one or more spills that could occur as a result of ongoing activities in the Southern California Planning Area in the "50 to less than 1000 bbl" size range using Pacific Region oil spill rates (Table A-2). Oil spill occurrence is calculated as a function of the volume of oil handled or the amount of oil that could be exposed. Oil exposed is defined as the volume of oil produced or transported within a given area. Therefore, the total amount of oil that could be economically produced in the Southern California Planning Area was used as this exposure variable. In the "50 to less than 1,000 bbl" size range we estimate there will be 1.69 spills with a 81.5 % probability of an oil spill occurring (Table A-2). Note that the 80,000 bbl 1969 spill was not included in this calculation since it does not fall within the 50 to1000 bbl size range.

For comparison, we calculated oil spill probabilities using oil spill rates derived from all United States Outer Continental Shelf (US OCS) operations (1996-2010) and the total amount of oil that could be economically produced in the Southern California Planning Area (Anderson et. al., 2012). Using spill rates based on all US OCS Operations (1996-2010), the probability of one or more spills occurring in the Pacific Region for the "50 to less than 1,000 bbl" size range is 98.9 %. The lower probability (81.5 %) of spills in the "50 to less than 1,000 bbl" size range using POCSR oil spill data is reflective of the lower number of oil spills throughout POCSR production history. Using spill rates based on all US OCS operations (1996-2010), the probability of one or more spills occurring in the greater than 1,000 bbl size range is 34.7 % (Table A-3). This is a conservative estimate based on overall US OCS operations. For the greater than 1,000 bbl size range, we did not calculate oil spill rates with only POCSR data due to the limited dataset (1 spill > 1,000 bbl occurred in 1969). A spill of this size would be an unlikely event in the POCSR.

[1] From 1996 to 2010, the overall OCS average spill size in the size range of "50 to less than 1,000 bbl" is 186 bbl (Anderson et al., 2012).

Table A-1. Crude, diesel, or other hydrocarbon spills recorded in the POCSR, 1963 through 2015. [volume in barrels (bbl)].

	Less than or equal to 1 BBL		Greater than 1 BBL and less than 50		Equal to or More than 50 BBL		Total		Cumulative Since 1969
YEAR	NO.	VOLUME	NO.	VOLUME	NO.	VOLUME	NO.	VOLUME	VOLUME
1963	0	0.00	0	0.00	0	0.00	0	0.00	
1964	0	0.00	0	0.00	0	0.00	0	0.00	
1965	0	0.00	0	0.00	0	0.00	0	0.00	
1966	0	0.00	0	0.00	0	0.00	0	0.00	
1967	0	0.00	0	0.00	0	0.00	0	0.00	
1968	0	0.00	0	0.00	0	0.00	0	0.00	
1969	0	0.00	0	0.00	2	80900.00	2	80,900.00	
1970	0	0.00	0	0.00	0	0.00	0	0.00	0.00
1971	0	0.00	0	0.00	0	0.00	0	0.00	0.00
1972	0	0.00	0	0.00	0	0.00	0	0.00	0.00
1973	0	0.00	0	0.00	0	0.00	0	0.00	0.00
1974	0	0.00	0	0.00	0	0.00	0	0.00	0.00
1975	1	0.10	0	0.00	0	0.00	1	0.10	0.10
1976	3	1.10	1	2.00	0	0.00	4	3.10	3.20
1977	11	2.20	1	4.00	0	0.00	12	6.20	9.40
1978	4	1.20	0	0.00	0	0.00	4	1.20	10.60
1979	5	1.70	1	2.00	0	0.00	6	3.70	14.30
1980	11	4.90	2	7.00	0	0.00	13	11.90	26.20
1981	21	6.00	10	75.00	0	0.00	31	81.00	107.20
1982	24	3.20	1	3.00	0	0.00	25	6.20	113.40
1983	56	7.70	3	6.00	0	0.00	59	13.70	127.10
1984	65	4.70	3	36.00	0	0.00	68	40.70	167.80
1985	55	9.30	3	9.00	0	0.00	58	18.30	186.10
1986	39	5.50	3	12.00	0	0.00	42	17.50	203.60
1987	67	7.50	2	11.00	0	0.00	69	18.50	222.10
1988	47	3.70	1	2.00	0	0.00	48	5.70	227.80
1989	69	4.10	3	8.33	0	0.00	72	12.43	240.23
1990*[1]	43	2.70	0	0.00	1	101.00	44	103.70	343.93
1991*[2]	51	2.80	1	13.00	1	50.00	53	65.80	409.73
1992	39	1.20	0	0.00	0	0.00	39	1.20	410.93
1993	32	0.76	0	0.00	0	0.00	32	0.76	411.69
1994*[3]	18	0.40	2	33.00	1	50.00	21	83.40	495.09
1995	25	0.90	1	1.43	0	0.00	26	2.33	497.42
1996*[4]	39	0.90	1	5.00	1	150.00	41	155.90	653.32
1997*[5]	20	1.50	0	0.00	1	164.00	21	165.50	818.82
1998	29	1.00	0	0.00	0	0.00	29	1.00	819.82
1999	26	1.35	1	10.00	0	0.00	27	11.35	831.17
2000	36	1.00	0	0.00	0	0.00	36	1.00	832.17
2001	48	1.70	0	0.00	0	0.00	48	1.70	833.87
2002	55	1.30	1	9.00	0	0.00	56	10.30	844.17
2003	56	1.37	0	0.00	0	0.00	56	1.37	845.54
2004	36	1.00	0	0.00	0	0.00	36	1.00	846.54
2005	46	2.60	0	0.00	0	0.00	46	2.60	849.14
2006	46	1.99	0	0.00	0	0.00	46	1.99	851.13
2007	45	1.19	1	1.19	0	0.00	46	2.38	853.51
2008	45	1.20	1	27.00	0	0.00	46	28.20	881.71
2009	36	1.10	0	0.00	0	0.00	36	1.10	882.81
2010*[6]	33	0.63	0	0.00	0	0.00	33	0.63	883.44
2011	38	0.02	0	0.00	0	0.00	38	0.02	883.46
2012*[7]	30	0.08	1	35.70	0	0.00	31	35.78	919.24
2013	26	0.03	0	0.00	0	0.00	26	0.03	919.27
2014	10	0.48	0	0.00	0	0.00	10	0.48	919.75
2015	13	0.11	0	0.00	0	0.00	13	0.11	919.86
TOTALS	1399	92.21	44	312.65	7	81415.00	1450	81,819.86	919.75

*[1] Mineral oil mud released due to incorrectly positioned standpipe and closed valves
*[2] Pipeline riser ruptured when snagged by grappling hook used by workboat to retrieve lost anchor
*[3] Process upset resulting in overflow of oil/water emulsion from tanks into disposal tube
*[4] Equipment failure and error allowing emulsion to flow through flare boom
*[5] Pipeline break in the flange metal in state waters due to welding flaws
*[6] Since January 2010 spills recorded in Technical Information Management System in .01 gallons
*[7] Includes Platform Houchin 35 bbl spill (per USCG) from burst plate

Oil spill probability estimates are conservative given POCSR's:

- oil spill history,
- long established drilling program,
- producing from mature fields with lower pressure,
- no floating drilling rigs,
- no new platforms being installed, and
- all oil is transported via pipelines.

Table A-2 Estimated mean number of spills and spill occurrence probability for the "50 to less than 1,000 bbl" size range using oil spill data from POCSR operations (1963 – 2011). Anticipated POCSR Production is 0.3373 Bbbl (0.262 [BSEE August 2016] + 0.0957 [Tranquillon Ridge] + 0.0035 [Electra Field] + 0.0161 [Carpinteria State] = 0.3373 Bbbl).

POCS Spill data (1963 – 2014)	Spill Rate (2012*)	Estimated Mean Number of spills	Probability of 1 or more spills
Spills ≥ 50 to < 1,000			
Platforms & Pipelines	4.47	1.69	81.5 %

Bbbl = billions of barrels *spill rate calculation methodology: Anderson et. al., 2012

Formulae used in the Oil Spill Occurrence and Probability Calculations:
Spill rate λ = number of spills per Bbbl
Estimated Mean Number of Spills = spill rate λ x volume handled t (Bbbl) = λ t
Probability [n spills over future exposure t] = $[(\lambda\ t)^n e^{-\lambda t}] / n!$
Probability of Zero Spills = $[(\lambda\ t)^0 e^{-\lambda t}] / 0! = [1 \times e^{-\lambda t}] / 1 = e^{-\lambda t} = 1 / e^{\lambda t}$
Probability of One or More Spills = 1-Probability[zero spills] = $1 - 1 / e^{\lambda t}$

Table A-3 Estimated means and spill occurrence probabilities POCSR analyses using all US OCS Spill Data (1996 – 2010). Anticipated POCSR production is 0.3373 Bbbl.

US OCS Spill Data (1996 – 2010)	Spill Rate (2012*)	Estimated Mean Number of Spills	Probability of 1 or More Spills
Spills ≥ 50 to < 1,000			
Platforms & Pipelines	12.88	4.86	99.2 %
Spills ≥ 1000			
Platforms	0.25	0.09	9.0 %
Pipelines	0.88	0.33	28.3 %
Total	1.13	0.43	34.7 %

Bbbl = billions of barrels. * Source: Anderson et. al., 2012

Oil spill Assessment 1970s and 1980s

The 1975 Environmental Impact Statement (EIS) for Oil Development in the Santa Barbara Channel estimated 1 to 2 billion barrels (Bbbl) of oil would be produced (USGS, 1975). To date the Southern California Planning area has produced 1.3 Bbbl of oil with a remaining production estimate of 0.3373 Bbbl. Therefore, the production estimates for the region are within what was estimated in the 1975 EIS. This section reviews, by geographic location, the oil spill assessments completed in the 1970s and 1980s environmental documents.

Santa Maria Basin:

- 1985 Santa Maria Basin EIS/EIR analyzed oil spills ranging from 10 to 100,000 bbl (ADL, 1985). (Platforms covered: Irene)
- Spills since 1969:
  - Platform Irene – 1997 – 164 bbl pipeline spill

Santa Barbara Channel:

- USGS 1975 EIS: estimated a 70 % chance that there would be at least one platform spill of 1,000 bbl, and if a large platform spill occurred, there was an 80 % chance the spill would exceed 2,380 bbl (USGS, 1975). (Platforms covered: Hogan, Houchin, Hillhouse, A, B, C, Henry, Grace, Habitat)
- 1980 Environmental Impact Report – Environmental Assessment (EIR-EA) for the Platform Gina and Gilda development: estimated that an average rate of operational platform spills is 1 spill per production platform per 10.6 years (Dames and Moore, 1980). Thus, it was estimated that Platform Gilda would have 1.9 spills over the 20 year production lifetime. (Platforms covered: Gina, Gilda)
- 1986 Platform Gail Environmental Assessment (EA): cumulative oil spill analysis estimated that during 32 years of production in the Southern California Planning Area there would be 14.5 spills ≥ 1,000 bbl and 6.6 spills ≥ 10,000bbl (MMS, 1986). (Platforms covered: Gail)
- 1984 Santa Ynez Unit Environmental Impact Report/Environmental Impact Statement (EIR/EIS): examined spills ranging from 10 bbl to more than 500,000 bbl and categorized a platform blowout as spilling between 1,000 and 500,000 bbl (SAI, 1984). (Platforms covered: Hondo, Harmony, Heritage[2])
- 1984 Point Arguello EIR/EIS estimated that a cumulative total of 144,000 bbl of oil would be expected to be spilled over a 30-year project lifetime (ADL, 1984, Appendix H). (Platforms covered: Hidalgo, Harvest, Hermosa)
- Spills since 1969, ≥ 50 bbl:
  - Platform Habitat: 1990 – 100 bbl of drilling mud with mineral oil
  - Platform Gina: 1991 – 50 bbl of oil from a broken pipeline
  - Platform Hogan: 1994 – 50 bbl of oil
  - Platform Heritage: 1996 – 150 bbl of oil

San Pedro Bay:

- 1978 Beta Unit EIR-EA analyzed the following spills: 5000-bbl platform spill, 50-bbl pipeline spill, 50-bbl Long Beach Harbor spill, and a catastrophic 80,000-bbl platform spill (SLC, PLB, USGS, 1978). (Platforms covered: Elly, Ellen, Eureka, Edith)

<u>Worst Case Discharge</u>

Pacific OCS Region operators are required to submit oil spill response plans (OSRPs) which show the worst case volume of oil that could be spilled from three sources associated with

[2] A fourth platform was also covered by this document, but never installed. The platform has since been removed from the current Development and Production Plan for the Santa Ynez Unit.

offshore operations: vessels, tanks, and piping on board platforms, pipelines, and loss of well control events (Table A-4; 30 CFR 254; 30 CFR 550). The intent of this conservative requirement is to ensure that each operator has adequate spill response capabilities to respond to the largest conceivable oil spill from their facilities. If surface intervention is unsuccessful, an operator needs to mobilize a drilling rig to the Southern California Planning Area and drill a relief well. The largest worst case discharge volume is calculated as the release of stored oil on a platform, oil in the associated pipeline, plus the total flow released from a loss of well control up to the drilling of a relief well. The worst case discharge volumes vary widely across facilities. A continuous spill event (i.e., from a loss of well control) is more difficult to quantify but unlikely to occur given the reservoir pressures in the POCSR (13 of the 23 platforms have no pressure; Table A-4).

Worst Case Discharge Scenario, Largest Volume in POCSR

Platform Heritage, Santa Ynez Unit, located approximately 8 miles offshore Gaviota, California, has the largest worst case discharge estimate for a loss of well control (blowout) with an estimated maximum daily flow rate of 33,986 barrels. It is estimated to take 17 days to stop the flow using surface capping equipment, for a total discharge volume of 577,762 bbl. If surface intervention is not achieved, the estimated maximum time it would take to mobilize a rig and drill a relief well would be 170 days, with a total discharge volume of 5,777,620 bbl. This catastrophic event is unlikely to occur.

<u>Summary of Oil Spill Risk Assessment</u>

- The maximum most likely oil spill volume is estimated to be 200 bbl.
- The probability of an oil spill occurring in the 50 to less than 1,000 bbl range is 81.5 %.
- Projected oil production in the Southern California Planning Area is within what was analyzed in the environmental documents from the 1970s and 1980s.
- A large catastrophic event is unlikely to occur.

A.2 Fate of Oil

In the event of an accidental oil spill, a slick forms and part of the slick begins evaporating while the action of breaking waves forms oil droplets that are dispersed into the water column. Oil in the Southern California Planning Area ranges from very heavy (API 12) to very light (API 39). Light oil has a rapid evaporation rate and is soluble in water. Light crude oils can lose up to 75 % of their initial volume within a few days of a spill (NRC, 2003). In contrast, heavy oil (API <22) has a negligible evaporation rate and solubility in water.

Depending on the weight of the oil spilled and the environmental conditions (i.e., sea state) at the time of a spill, six to 60 % of oil during an oil spill would sink and be in the water column or on the seafloor in the vicinity of the spill (ADL, 1984). This is supported by a recent study of natural oil seeps at Coal Oil Point in the Santa Barbara Channel that range in depth from six to 67 meters offshore of Goleta, CA (Leifer et al., 2006) and are assumed to release 100 bbl/day (Farwell et al., 2009). The distribution of heavy oil in a surface slick in the Santa Barbara Channel is primarily influenced by surface currents and falls out of the slick over a period of 0.4 to 5 days (Leifer et al., 2006).

Table A-4. Worst Case Discharges Identified in OSRPs in the POCSR.

Facility	Pipeline (bbl)	Storage[3] (bbl)	Drilling (bbl/day)	Reference
Hogan	Pipeline to Shore = 41 (oil + water) Inter-Platform (Houchin) = 49	324	0	Pacific Operators Offshore OSRP 2012
Houchin	See Information for Hogan	324	0	Pacific Operators Offshore OSRP 2012
Elly	16" Pipeline Elly to Beta Pump Station = 3,111	8,925	0 (no drilling)	Beta Unit Complex OSRP 2012
Ellen	No Pipeline, transfers through Elly = 0	1840	45	Beta Unit Complex OSRP 2012
Eureka	Pipeline = 1,026	4,232	105	Beta Unit Complex OSRP 2012
Gail	Pipelines at Gail = 168	2,068	650	Santa Clara Unit OSRP 2012
Grace	Pipelines at Grace and Grace to Shore = 292	1,557	110	Santa Clara Unit OSRP 2012
Hermosa	Pipeline Hermosa to Shore = 2,502	3,760	0	Plains Exploration and Production Company OSRP 2012
Hidalgo	Pipeline Hidalgo to Hermosa = 489	2,478	0	Plains Exploration and Production Company OSRP 2012
Harvest	Pipeline Harvest to Hermosa = 221	3,820	0	Plains Exploration and Production Company OSRP 2012
Irene	Pipeline Irene to Shore = 1,124	1,064	750	Plains Exploration and Production Company OSRP 2012
Gilda	Pipeline Gilda to Shore = 1,994	857	200	DCOR OSRP 2012
Gina	Pipeline Gina to Shore = 546	223	0	DCOR OSRP 2012
"C"	Pipeline C to B = 11	306	2	DCOR OSRP 2012
"B"	Pipeline B to A = 92	646	0	DCOR OSRP 2012
"A"	Pipeline A to Shore = 3,685	589	0	DCOR OSRP 2012
Hillhouse	Pipeline Hillhouse to A = 57	1,534	0	DCOR OSRP 2012
Henry	Pipeline Henry to Hillhouse = 3	118	0	DCOR OSRP 2012
Edith	Pipeline Edith to Elly = 122	2,352	0	DCOR OSRP 2012
Habitat	No Pipeline, gas production	385	0	DCOR OSRP 2012
Harmony	Pipeline Harmony to Shore = 6,210	2,607	< 2,000	ExxonMobil OSRP 2014
Heritage	Pipeline Heritage to Harmony = 731	2,684	33,986	ExxonMobil OSRP 2014
Hondo	Pipeline Hondo to Harmony = 560	3,811	< 2,000	ExxonMobil OSRP 2014

[3] Vessels, piping, tanks

A.3 Oil Spill Response

BSEE regulations at 30 CFR Part 254 require that each OCS facility have a comprehensive OSRP. Response plans consist of an emergency response action plan and supporting information that includes an equipment inventory, contractual agreements with subcontractors and oil spill response cooperatives, worst-case discharge scenario, dispersant use plan, in-situ burning plan and details on training and drills. The Coast Guard is the lead response agency for oil spills in the coastal zone and coordinate the response using a Unified Command (UC), consisting of the affected state and the Responsible Party (i.e., the company responsible for spilling the oil) in implementing the Incident Command System (ICS) if an oil spill occurs. Oil spill drills, either agency-lead or self-lead by a company, also use the UC/ICS. California's Department of Fish and Wildlife's Office of Spill Prevention and Response (OSPR) assumes the role of the State on-scene coordinator and plays a significant role in managing wildlife operations in the Southern California Planning Area as the state's Natural Resource Agency.

BSEE requires companies that operate in the OCS to have the means to respond to a worst-case discharge from their facilities. Many companies meet this requirement by becoming members of Oil Spill Removal Organizations (OSRO). Since 1970, oil companies operating in the Santa Barbara Channel and Santa Maria Basin have funded and operated a non-profit OSRO called Clean Seas (www.cleanseas.com). Clean Seas acts as a resource to its member companies by providing an inventory of state-of-the-art oil spill response equipment, trained personnel, training and expertise in planning and executing response techniques. Clean Seas personnel and equipment are on standby, ready to respond to an oil spill, 24 hours a day.

The Marine Spill Response Corporation (MSRC) is the other U.S. Coast Guard-classified OSRO based in Long Beach (www.msrc.org). MSRC is a nation-wide OSRO with multiple responder-class oil spill response vessels and oil spill response barges. They are also equipped to respond to an oil spill 24 hours a day.

Clean Seas and MSRC are both equipped and prepared to respond to oil spill threats to sensitive shoreline areas through the detailed and up-to-date information on sensitive areas and response strategies from the Los Angeles/Long Beach Area Contingency Plan (https://www.wildlife.ca.gov/OSPR/Preparedness/LA-LB-Spill-Contingency-Plan) and the California OSPR (https://www.wildlife.ca.gov/OSPR).

A.4 Oil Spill Trajectory Analysis

Oil spill trajectory modeling was conducted to determine the movement and fate of spilled oil if a spill occurred in the Southern California Planning Area from existing offshore oil and gas operations. The BOEM examined two available models: BOEM Oil Spill Risk Analysis (OSRA) and National Oceanic & Atmospheric Administration (NOAA) Office of Response & Restoration's General NOAA Operational Modeling Environment (GNOME). GNOME was developed by the Emergency Response Division (ERD) of NOAA's Office of Response and Restoration. This information can be used in conjunction with data from the oil spill risk assessment to provide perspective on the potential for exposure to spilled oil.

The OSRA model calculates numerous trajectories for hypothetical oil spills from pre-designated launch points by varying the wind and ocean current fields. Contact was evaluated in a grid encompassing the entire ocean region as well as grids located along the shoreline (Figure A-1; MMS 2000). Percent contact for a grid section is calculated by OSRA (e.g., Figures A-2 and A-

3). The OSRA trajectories are volume-independent and only show where oil would travel given that a spill occurred.

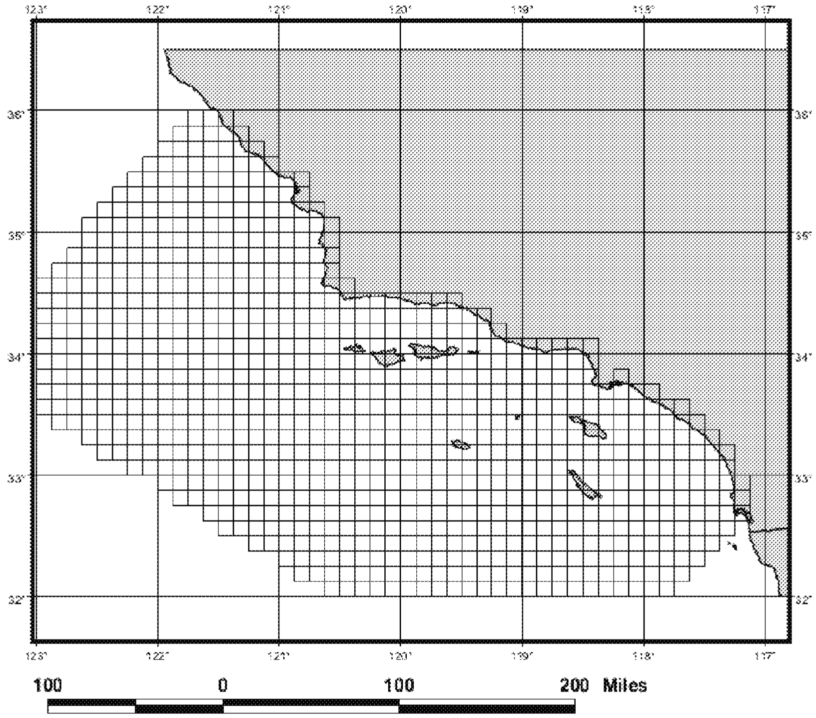


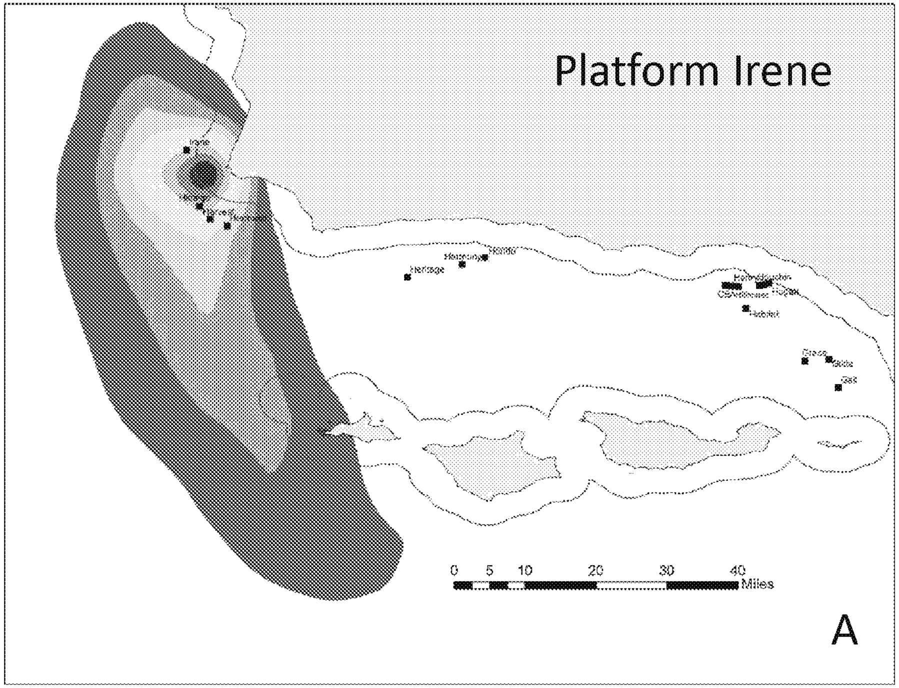
Figure A-1. Pacific OSRA Resource Grid. The centers of this grid are used as the data locations for the probability contour plots.

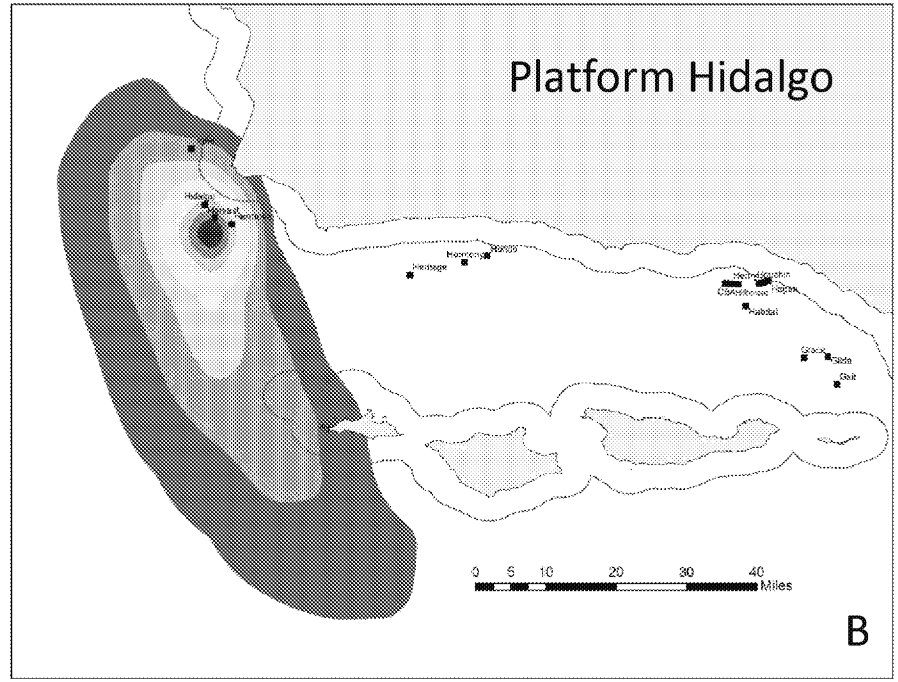
The BOEM ran the GNOME model in three oceanographic regimes (see Section A.5). Releases were modeled for three wind directions correlated with the ocean current flow regimes. The GNOME model takes ocean currents and wind into account. The contacts displayed in Figures A-4 – 8 are only for a limited set of meteorological conditions (Table A-5) and are not intended to encompass all of the meteorological conditions that could be present during a spill scenario. GNOME model outputs provide an overall picture of where oil may travel if an oil spill occurred from one of the launch points.

Table A-5. Parameters utilized in GNOME model runs.

Current Regime	Wind Conditions	Timeframe
Upwelling	8 m/s NW	10 days
Convergent	7 m/s NW	10 days
Relaxation	4 m/s NW 4 m/s SW 0 m/s	10 days

The GNOME analysis provides a slightly different picture of possible oil spill trajectories by including variables that account for the fate of the volume of oil released including weathering of released materials, specific ocean current regimes, and meteorological conditions. A volume of oil is assumed for GNOME model runs. As discussed in section A.1, the volume is 200 bbl for





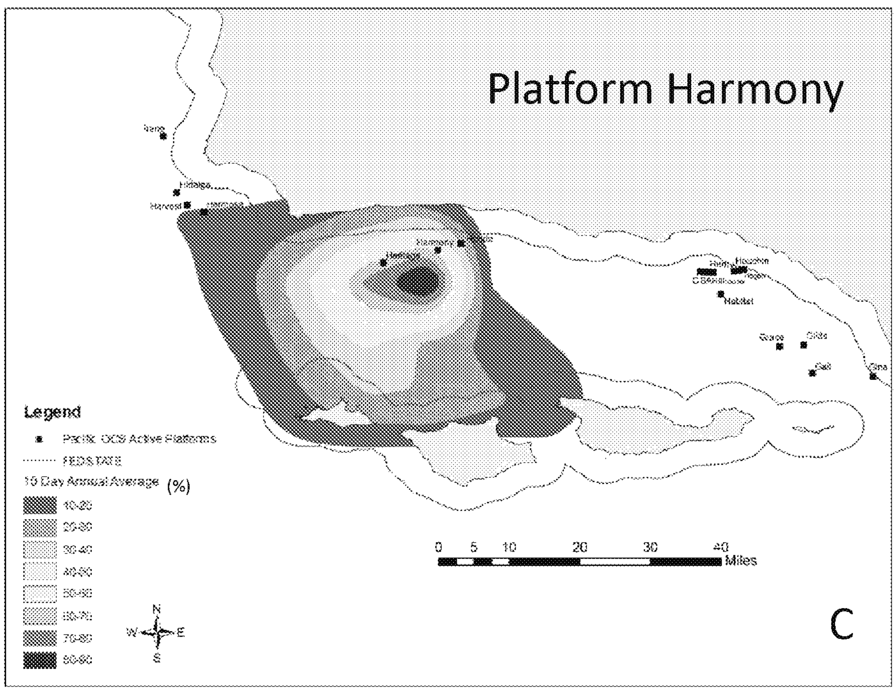
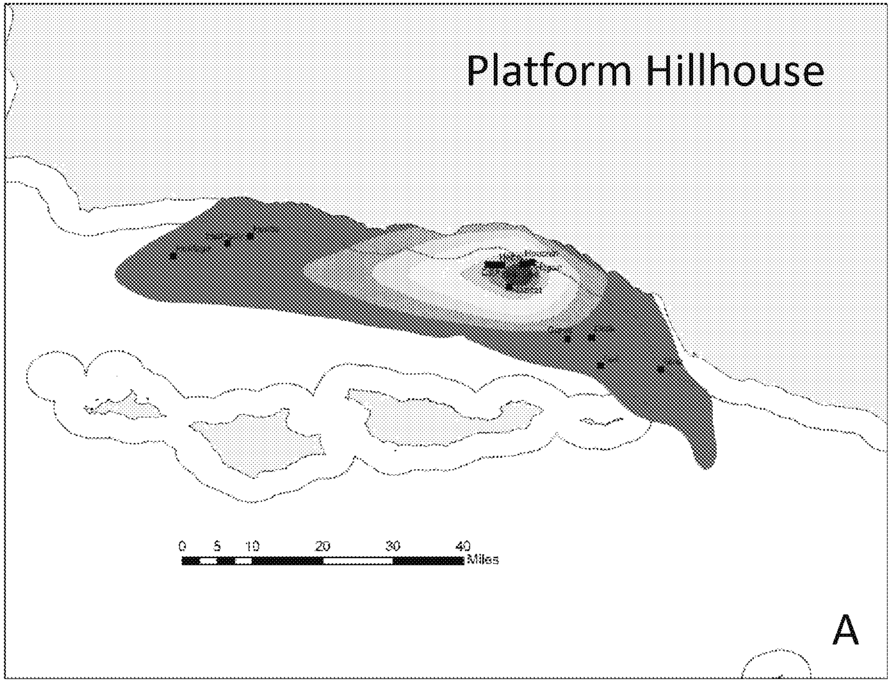
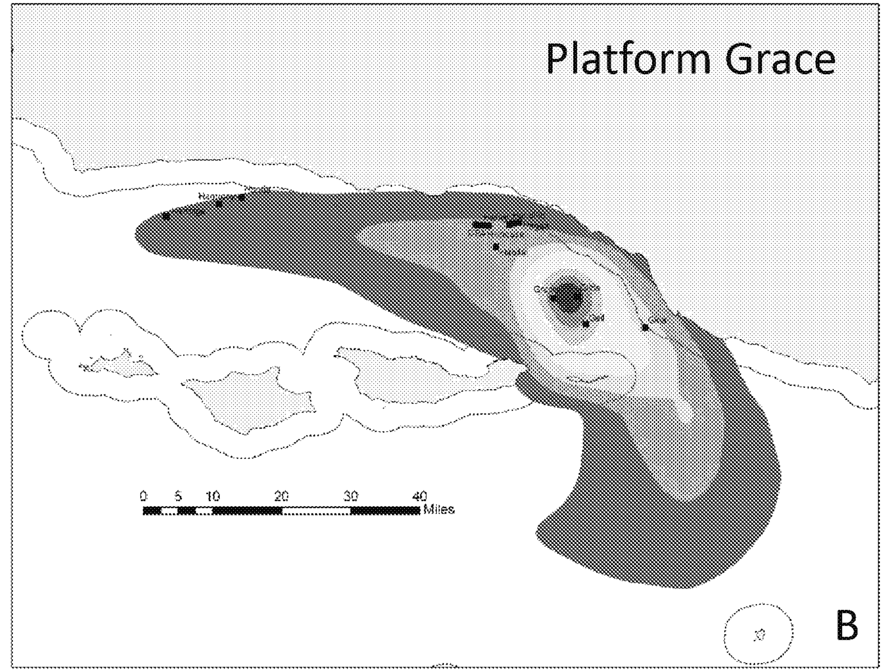


Figure A-2. Ten day annual average oil spill analysis for Platform Irene (A), Hidalgo (B) and Harmony (C). Percent probability that oil will contact certain land and ocean locations.





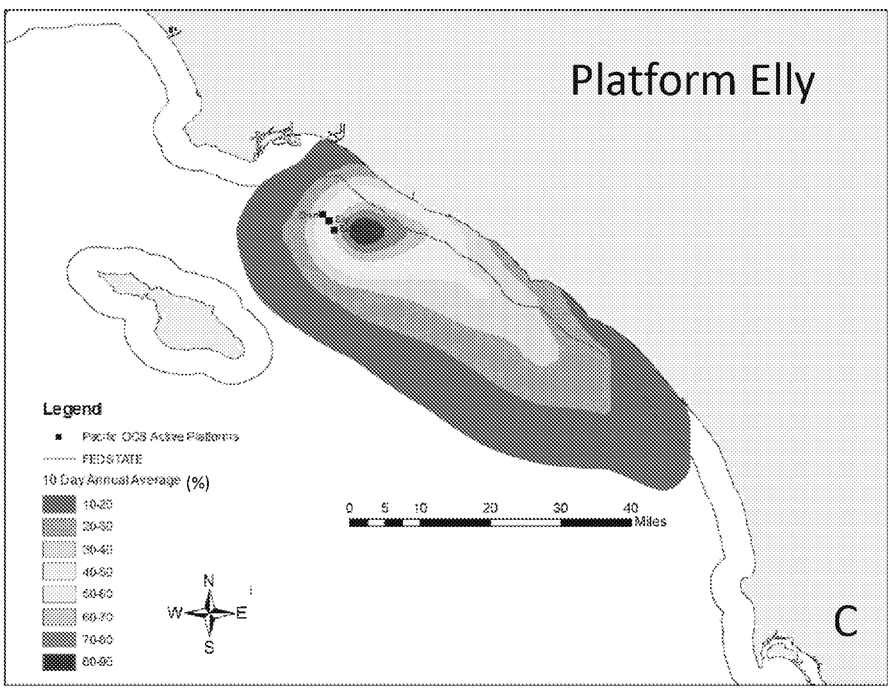
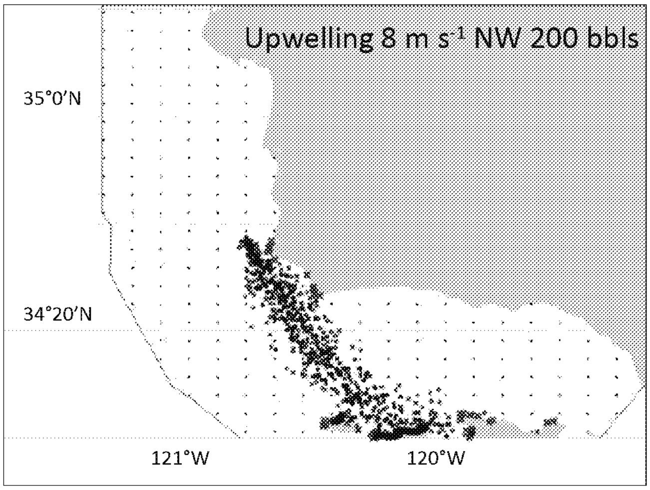
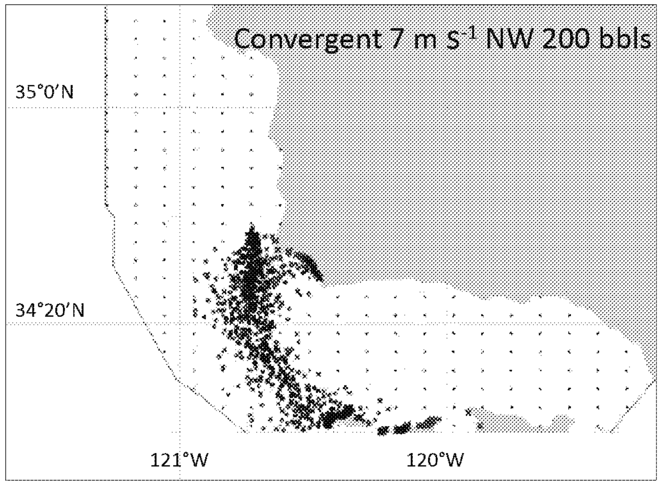
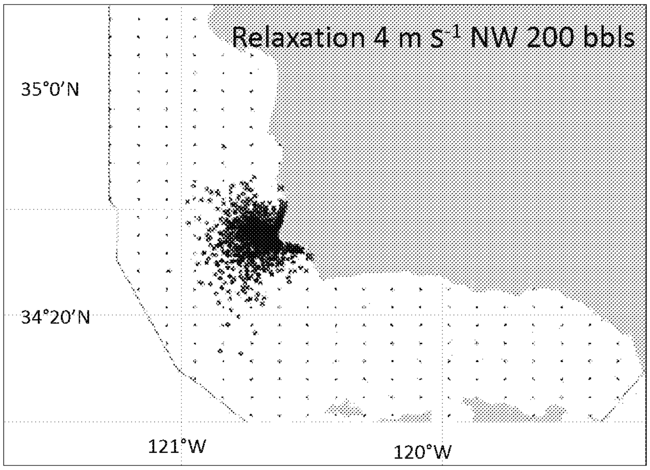
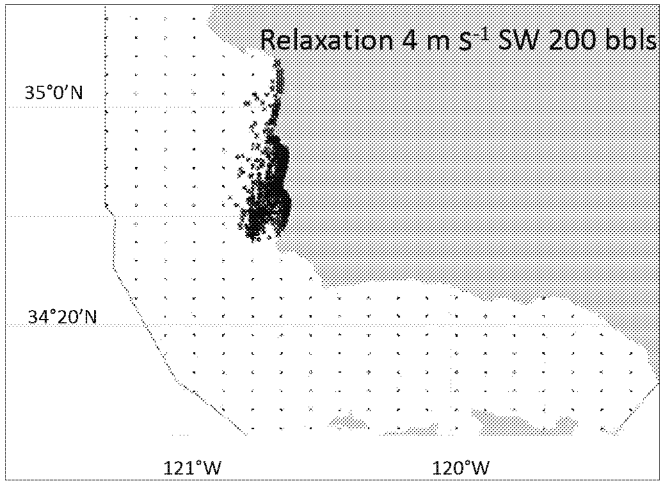


Figure A-3. Ten day annual average oil spill analysis for Platform Hillhouse (A), Grace (B) and Elly (C). Percent probability that oil will contact certain land and ocean locations.









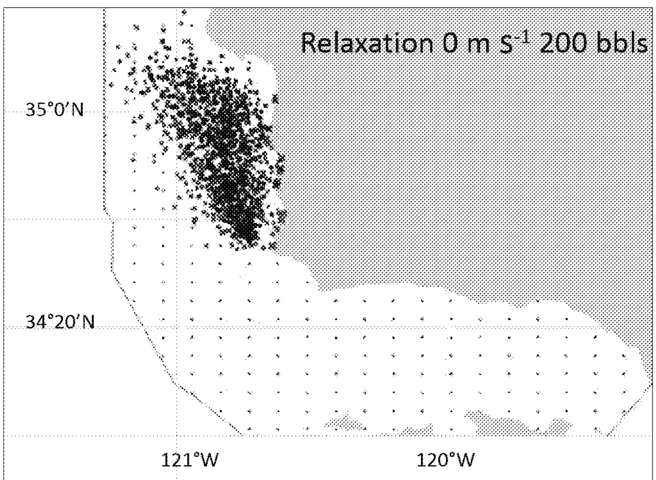


Figure A-4.
Platform Irene

<u>Northwest wind</u>: In the three oceanographic regimes, it takes one day for oil to land at Point Arguello. During the upwelling and convergent regimes oil lands at San Miguel island in 3-4 days, Santa Rosa in 4-5 days, and Santa Cruz Island in 4-9 days.

<u>Southwest and neutral wind</u>: In the relaxation regime it takes 1-2 days for oil to land at Purisima Point and 3-6 days for oil to land at Point Sal.

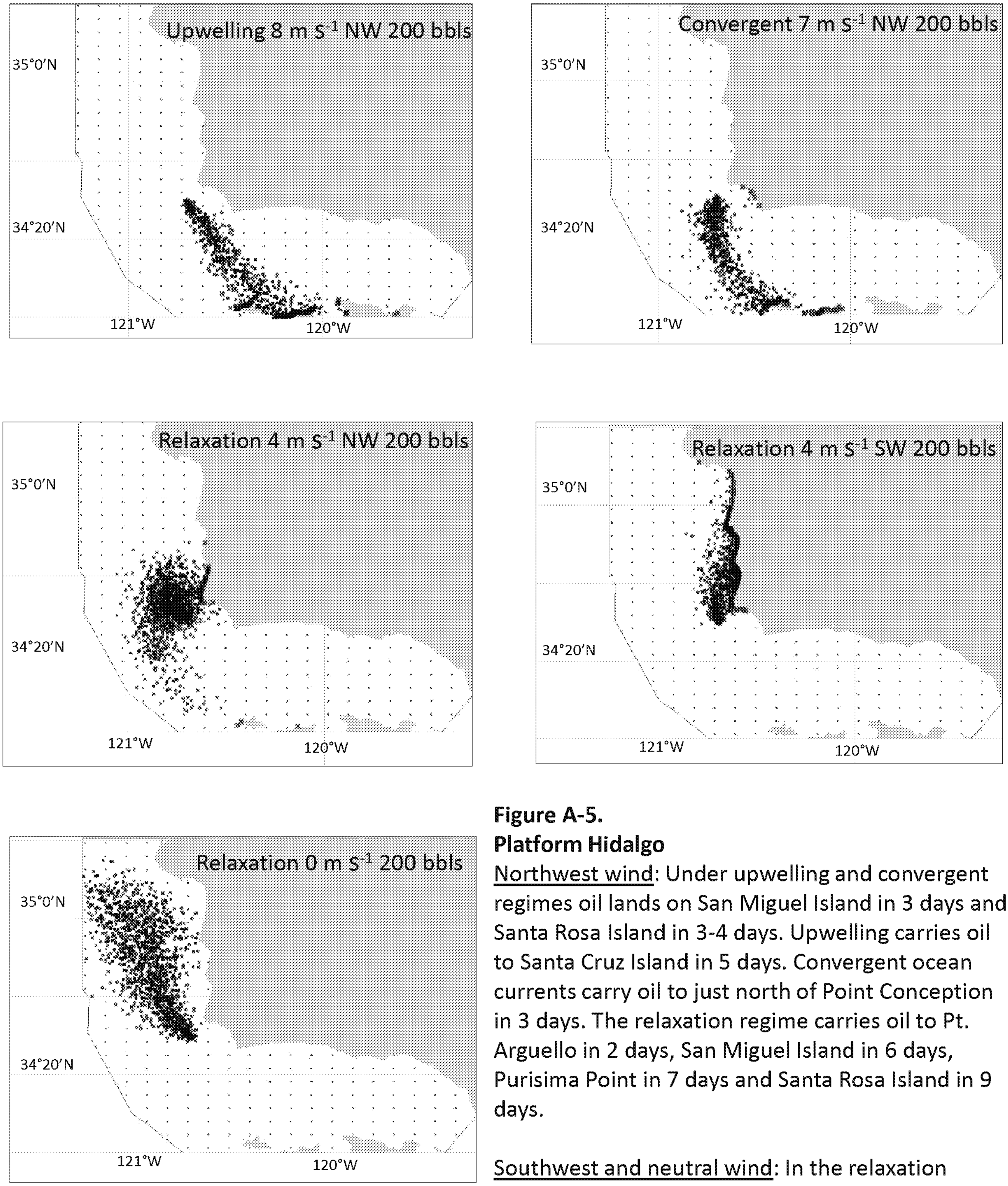
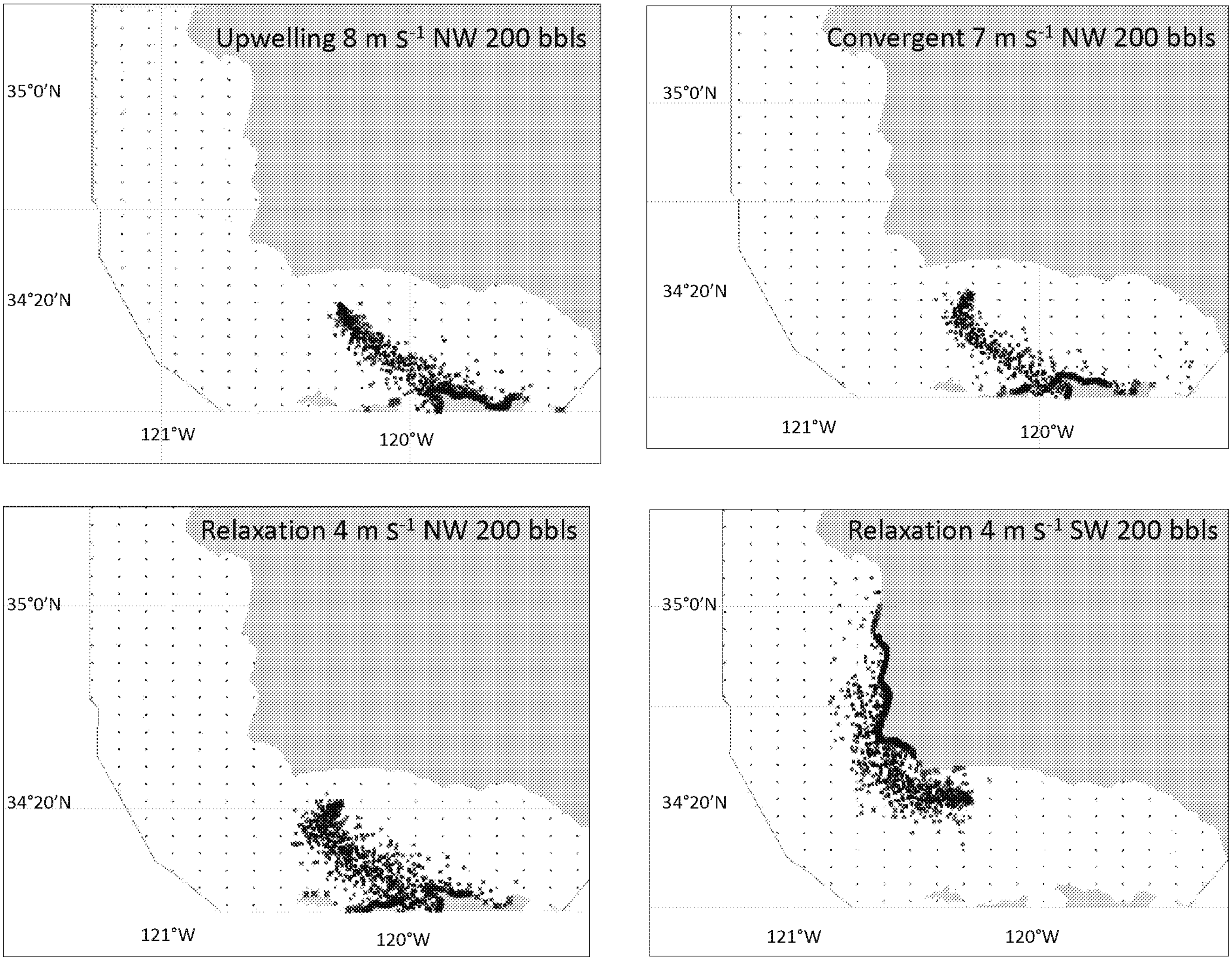


Figure A-5.
Platform Hidalgo

Northwest wind: Under upwelling and convergent regimes oil lands on San Miguel Island in 3 days and Santa Rosa Island in 3-4 days. Upwelling carries oil to Santa Cruz Island in 5 days. Convergent ocean currents carry oil to just north of Point Conception in 3 days. The relaxation regime carries oil to Pt. Arguello in 2 days, San Miguel Island in 6 days, Purisima Point in 7 days and Santa Rosa Island in 9 days.

Southwest and neutral wind: In the relaxation regime with neutral wind it takes 8 days for oil to land at Pt. Sal. In the relaxation regime with southwest wind, oil lands at Point Arguello in 1 day, Purisima Point in 2 days, Point Sal in 3 days and Pismo Beach in 7 days.



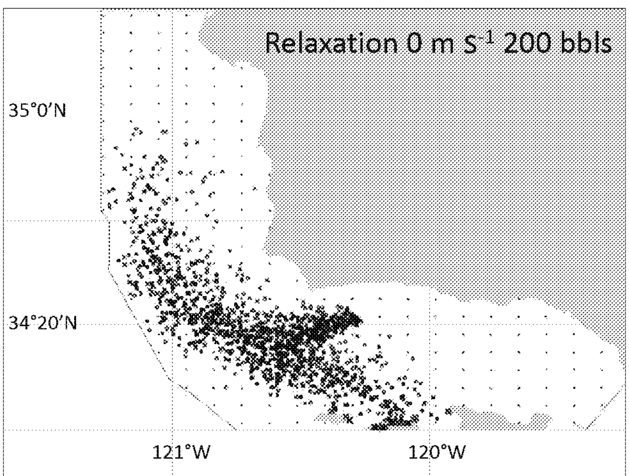
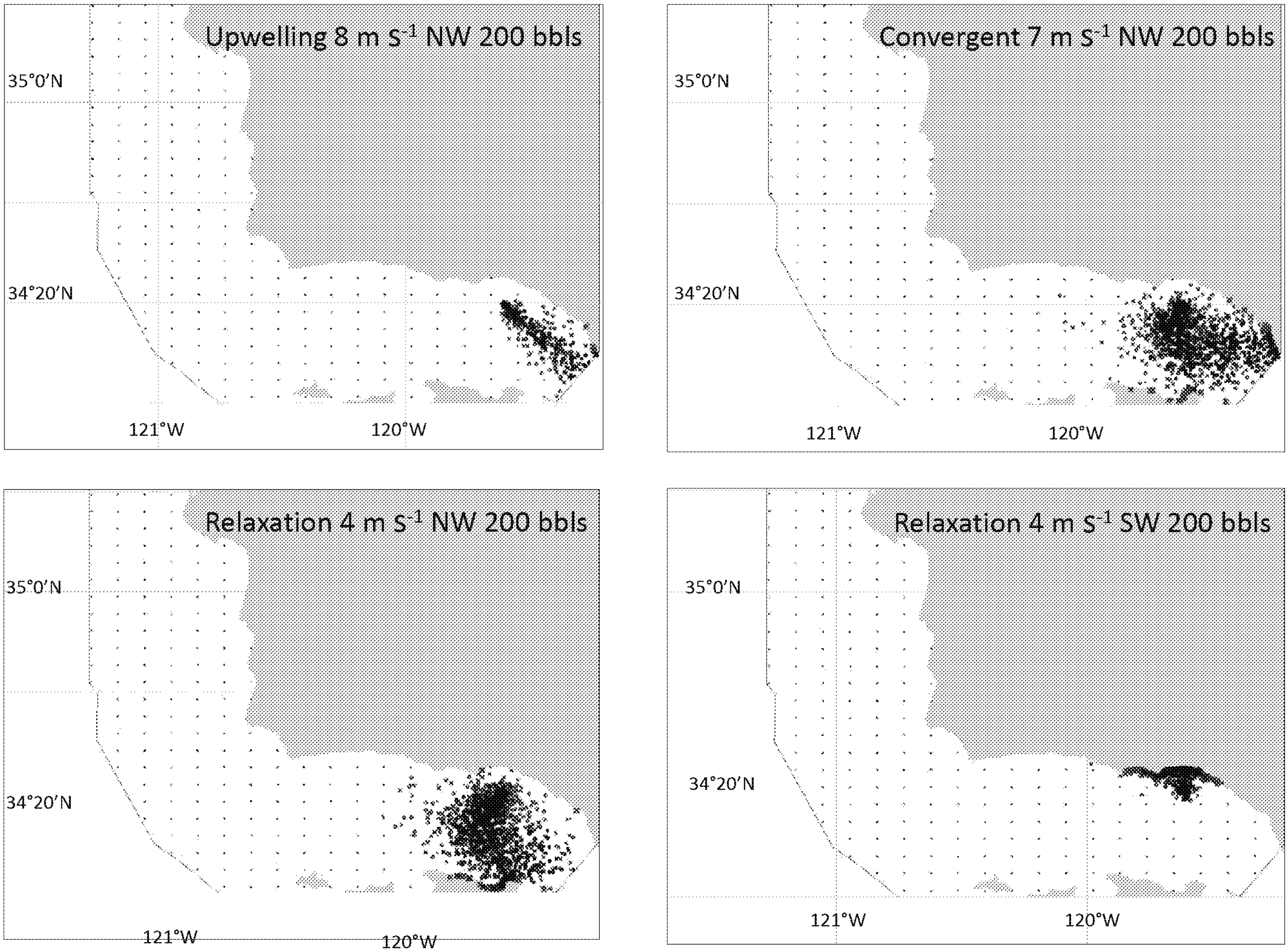


Figure A-6.
Platform Harmony

Northwest wind: Under upwelling and convergent regimes oil lands on Santa Cruz and Santa Rosa Islands in 2 days. The upwelling regime also carries oil to Anacapa Island in 5 days. Under the relaxation regime oil lands on Santa Rosa Island in 3 days and San Miguel and Santa Cruz Islands in 4 days.

Southwest wind: Under the relaxation regime, oil lands at Point Conception in 1 day, Point Arguello in 2 days, Purisima Point in 6 days, and Point Sal in 7 days.

Neutral wind: Under the relaxation regime, oil lands on San Miguel Island in 5 days, Santa Rosa Island in 6 days and Santa Cruz Island in 10 days. Oil also travels in the ocean up the coast to Point Sal, but does not land on the mainland.



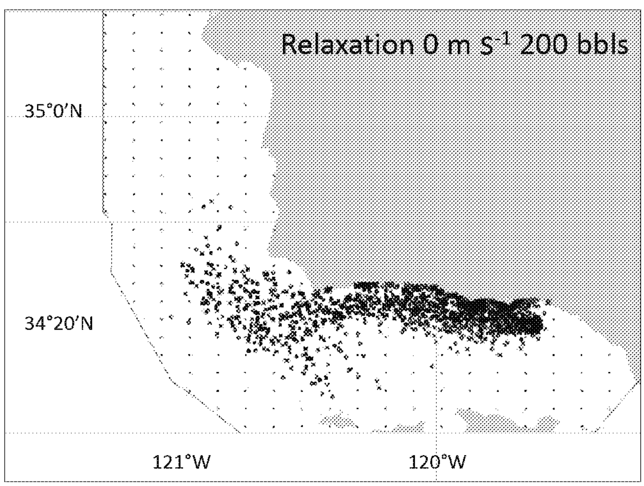
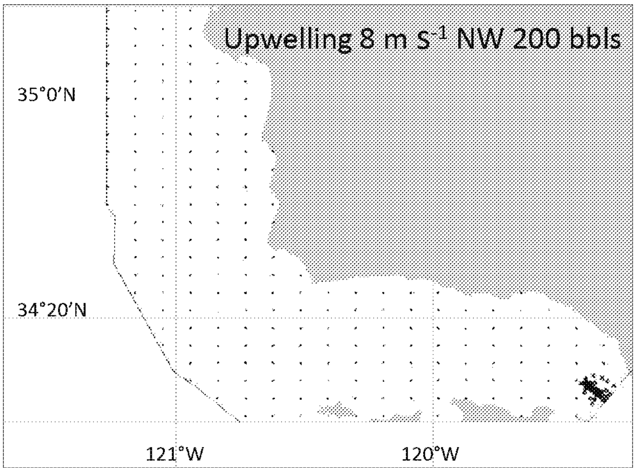
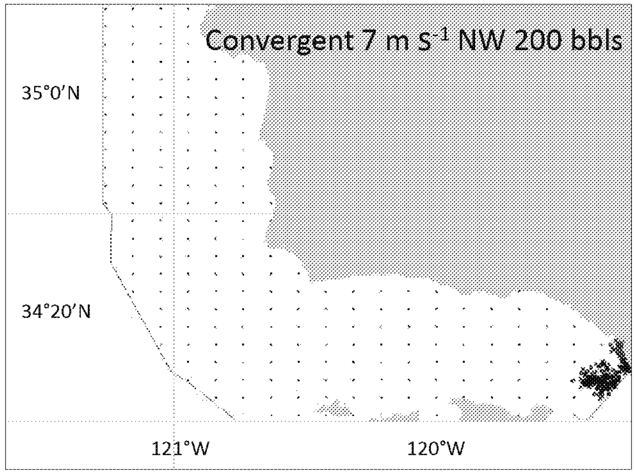


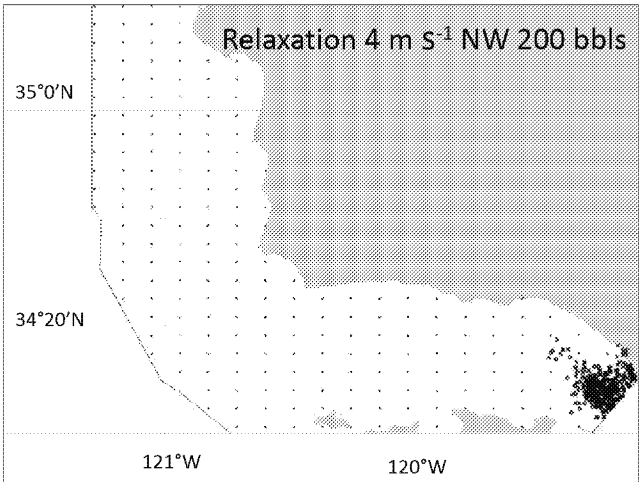
Figure A-7.
Platform Hillhouse
Northwest wind: Under the upwelling regime, oil lands on the mainland in Oxnard in 2 days and the majority of oil travels out of the model domain. In the convergent regime, oil lands on the mainland (Montecito and Carpinteria) in 3 days, Ventura Harbor in 4 days, Santa Cruz Island in 5 days, and Anacapa Island in 7 days. In the relaxation regime, oil lands on Carpinteria in 2 days, Santa Barbara in 3 days, Santa Cruz Island in 4 days and Anacapa Island in 8 days.

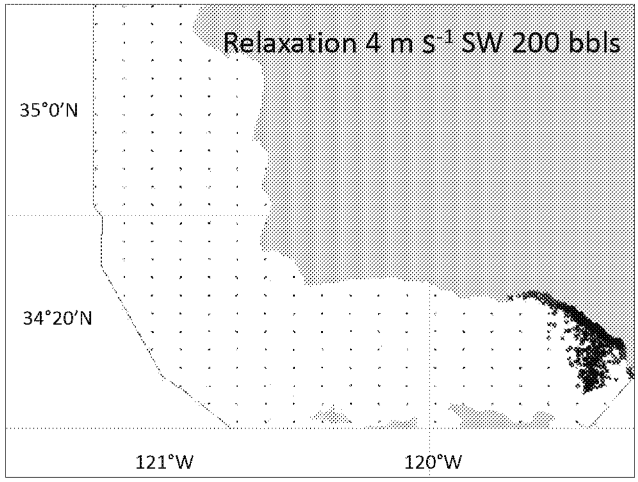
Southwest wind: Under the relaxation regime oil reaches Montecito in 1 day.

Neutral wind: Under the relaxation regime oil reaches Santa Barbara in 1 day and Point Conception in 7 days and continues out in the ocean parallel with Purisima Point.









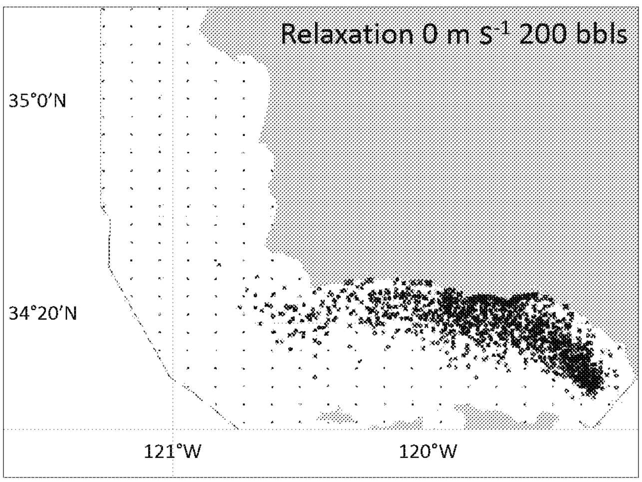


Figure A-8.
Eastern Channel Group-Platforms Gail, Grace, Gina, Gilda

Northwest wind: Under all three regimes the majority of oil travels out of the model domain. Under the upwelling regime, oil may land at Anacapa Island after 9 days. Under the convergent regime oil lands just south of Ventura Harbor in 1 day. In the relaxation regime oil lands south of Ventura Harbor in 4 days and on Anacapa Island in 8 days.

Southwest wind: Under the relaxation regime oil lands on Carpinteria and Ventura Harbor in 1 day.

Neutral wind: Under the relaxation regime oil lands on Carpinteria in 2 days, Santa Barbara in 4 days, and travels through the Santa Barbara Channel to just north of Point Conception.

the Pacific Region (see also Figures A-3 – A-8). Unlike OSRA, GNOME provides an estimated amount of oil that may contact the shoreline during the model run.

Although the GNOME results differ slightly from the OSRA model calculations, both analyses provide insights that help present a more complete picture of what may occur if oil is spilled. Together, these analyses represent the best available information on possible oil spill trajectories in the Southern California Planning Area. A detailed description of both models is provided at the end of this technical appendix in section A.5.

Trajectory Analysis and Comparison to 1970s and 80s

Six platforms were chosen as launch points because they are distributed throughout the geographic range of existing offshore operations as follows:

- *Santa Maria Basin* – Platforms Irene and Hidalgo;
- *Santa Barbara Channel* – Platforms Harmony, Hillhouse and a group in the eastern Channel (Gail, Grace, Gilda and Gina); and
- *San Pedro Bay* – Platform Elly.

The model outputs were then compared to the oil spill trajectories analyzed in the 1970s and 1980s environmental documents.

Santa Maria Basin

Platform Irene. In the Arthur D. Little (1985) EIR/EIS, model outputs focused on the probability of oil contacting a section of shoreline extending north of the Santa Maria River mouth, south and west to Santa Barbara, as well as San Miguel, Santa Rosa, and Santa Cruz islands (northern Channel Islands, not including Anacapa Island). These trajectories are essentially the same as those estimated using the current oil spill models. All of the models estimate that areas of the coastline from the Santa Maria River mouth to Gaviota and the northern Channel Islands were most likely to be affected by an oil spill from Platform Irene. (Figures A-2A and A-4). The OSRA analysis for Platform Irene displays the highest probability (50 – 60 %) of oil contacting land at Point Arguello and a 10 – 20 % chance of contact at San Miguel Island (Figure A-2A). GNOME models spilled oil traveling from Platform Irene to as far north as San Luis Obispo Bay and off the coast of Montana De Oro State Park. The northern-most mainland contact is just south of Pismo Beach at Guadalupe-Nipomo Dunes National Wildlife Refuge (Figure 4).

Platform Hidalgo. In the Arthur D. Little (1984) EIR/EIS, the trajectories estimated for oil spills launched near Platform Hidalgo are similar to those estimated using current oil spill models. All models estimated oil to contact land around Point Arguello and San Miguel Island. The Hidalgo OSRA analysis displays a 20 – 30 % probability of oil contacting Point Arguello and a 10 – 20 % chance of contact at San Miguel Island (Figure A-2B). The 1984 model and GNOME models also estimate land fall around Point Conception, Santa Rosa Island and Santa Cruz Island. The GNOME model estimates oil traveling further north up the coast to Point Sal and toward San Luis Obispo Bay (Figure 5).

Santa Barbara Channel

Platform Harmony. In the Science Applications, Inc. (1984) EIS/R, the trajectories estimated for oil spills launched near Platform Harmony are similar to those estimated using current oil spill models. All models agree that areas of coastline from Vandenberg Air Force Base to Santa Barbara County and northern coastlines of the Channel Islands are most likely to be affected by an oil spill from Platform Harmony. The primary differences are that the GNOME model runs estimate oil landing as far north as Point San Luis (Figure A-6) and the 1984 model analyses estimate oil landing as far south as San Nicolas and San Clemente Islands. Platform Harmony OSRA analysis displays a 20 – 30 % chance of oil contacting the mainland Gaviota coast and San Miguel Island and a 10 – 20 % chance of oil contacting Santa Rosa and Santa Cruz Islands (Figure A-2C).

Platform Hillhouse. The USGS (1975) EIS for the Santa Barbara Channel estimated oil spilled in this area to make contact with land around Carpinteria, Anacapa Island and travel down coast to Ventura. This is very similar to the OSRA model estimation, where there is a 30 – 40 % probability of oil contacting mainland Santa Barbara and a 10 – 20 % probability that oil will travel along the mainland as far north as the Gaviota coast and as far south as Ventura as well as out toward Anacapa Island (Figure A-3A). GNOME models oil traveling as far west as Santa Barbara and Point Conception (Figure 7).

Eastern Santa Barbara Channel

Platforms Grace, Gail, Gina, Gilda (modeling within a similar area). The USGS (1975) EIS for the Santa Barbara Channel indicated that oil in this area would contact land in Ventura, Port Hueneme, Anacapa Island, and possibly Point Mugu. The Dames & Moore, (1980) EIR-EA for Gina-Gilda described land contact would occur in the immediate vicinity of Port Hueneme and would range from the eastern Santa Barbara Channel to as far west as Santa Barbara. Oil would also likely contact the eastern shorelines of the northern Channel Islands. The 1986 Platform Gail EA also estimates this area of contact (MMS, 1986). This is similar to the GNOME model for Platform Gail that estimates landfall from mainland Santa Barbara to south of Ventura Harbor in Oxnard and out to Anacapa Island (Figure 8). A spill modeled in OSRA from Platform Grace displays a 40 – 50 % probability that oil will contact the east end of Anacapa Island and a 30 – 40 % probability that it will contact the entire island. There is a 20 – 30 % probability of contacting Port Hueneme and Santa Cruz Island and a 10 – 20 % probability of contacting the mainland as far north as Goleta and as far south as Point Mugu (Figure A-3B).

San Pedro Basin

Platform Elly. The 1978 Beta EIR\EA indicated that oil spilled from the Beta Unit, near the Ports of Los Angeles and Long Beach, would contact land from Alamitos Bay to Huntington Beach (SLC, PLB, USGS, 1978). They indicated that a catastrophic spill would contact the shoreline both up and down coast of the study area, but do not provide a specific area. This is similar to the OSRA model output that estimates spilled oil to primarily stay within the San Pedro Bay and travel south along the mainland to Oceanside (Fig A-3C). The OSRA analysis for the Beta Unit, Platform Elly, displays a 40 – 50 % probability of oil contacting the mainland from Huntington Beach to Newport Beach and a 10 – 20 % probability of oil traveling as far north as Alamitos Bay and as far south as Oceanside. No trajectory runs were conducted using GNOME because GNOME, as configured for this study, was limited to the geographic area of the Santa Barbara Channel and just north of Point Conception.

A.5 Oil Spill Trajectory Models – Technical Descriptions

BOEM OSRA Model

The trajectory simulation portion of the OSRA model consists of many hypothetical oil spill trajectories. The trajectories are the consequence of the integrated action of temporally and spatially varying wind and ocean current fields on the hypothetical oil spills. Collectively, they represent a statistical set of winds and currents that could occur during the chosen seasonal time of the model run. The analysis uses a combination of observed and theoretically computed ocean currents and winds. Ocean currents were generated by a numerical model and were supplemented with direct observations of currents using surface drifting buoys in the Santa Barbara Channel. The sea surface winds over the study area were derived from an atmospheric model and from measured winds at buoy, platform, island and land-based wind stations. The studies were conducted for four seasons (winter, spring, summer and fall) representing different currents and winds. The seasonally-averaged current fields were provided by Scripps Institution of Oceanography and are based on several years of current meter and free-floating drifter data (MMS, 2000).

The primary OSRA study area grid used for the trajectory analysis consists of a Cartesian grid over the area (123° W to 116.7° W) and (32° N to 36° N) (Figure 1). The land segments were established from the USGS quadrangle maps for the California Coast. The grid cell definitions are 1/8° (0.125°) in longitude and latitude. The grid is not fully rectangular; cells that fell on land, or outside the region where ocean currents were defined were removed. This resolution was selected by the OSRA specialist as an appropriate grid, based on the information at that time. This resource grid was defined to calculate the number of trajectories that entered into each cell during the trajectory movement and "color code" the probability of contact to each grid cell over a 10-day period from a platform launch point. In this analysis, we treated the probability estimates as a point grid at the centers of the grid cells, and then contoured the results. Therefore, the maximum contours do not necessarily surround the launch point, but rather the contours surround the center points of the resource grid. This occurs due to the coarse scale of the grid. The movements of the trajectories are treated as "floating" within this grid, in meters (Figure 1).

OSRA model results display the probabilities (in percent) of oil contacting different locations on land and in the water using the annual average for all four seasons over a 10-day period and creating contours to fit the contacted grid.

NOAA GNOME Model

GNOME is a publicly available oil spill trajectory model that simulates oil movement due to winds, currents, tides and spreading (Zelenke et al., 2012). It includes variables that account for weathering of the released materials as well as a separate set of ocean current regimes for the Santa Barbara Channel and Santa Maria Basin. Wind speed and direction as well as variability can be input to the model. This enables the analysis of specific spill situations under given meteorological conditions. However, in order to assess the probabilities of a specific modeled end result, wind distributions and ocean current time dependent distributions would need to be obtained and many modeling runs conducted for the area.

The GNOME model operates by generating "splots" associated with each spill scenario. The fate of the splots is either to remain in the water, to be beached, to be weathered or to travel out of the modeling space (off the map). The movement of the splots is defined by the ocean current "regime" and the wind influences. Ocean currents in GNOME are essentially divided into three regimes for the Santa Barbara Channel and the Santa Maria Basin: upwelling, convergent and relaxation. Each of the three ocean current states includes a counter-clockwise circulation pattern in the Santa Barbara Channel, although it is strongest in the convergent oceanographic regime (Figure A-9).

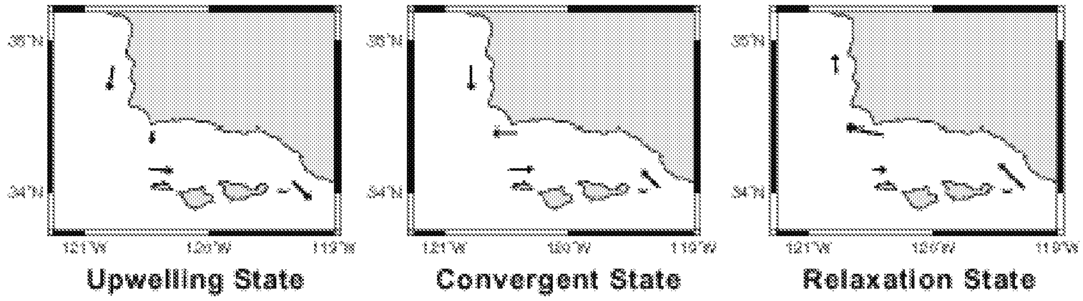


Figure A-9. Santa Barbara Channel oceanographic regimes (NOAA 2015, Dever 2004).

Upwelling. The upwelling state is named for the upwelling of cold (approximately 11 °C) subsurface waters near Point Conception that often accompanies this state. The upwelling state occurs primarily in spring, although it has also been observed in other seasons. In terms of the conceptual models of the momentum balance, the upwelling state occurs when strong (>10 m/s), persistent (several days or more), upwelling favorable (equatorward) winds overwhelm any poleward, along-shelf pressure gradient.

Convergent. The convergent state is named for the convergence of southward flow west of Point Arguello with westward flow south of Point Conception. The convergent state occurs primarily in summer, although it has also been observed in other seasons. The convergent state tends to occur when upwelling favorable winds and a strong poleward, along-shelf pressure gradient exist. The most characteristic feature of the resulting flow field is a strong counter-clockwise recirculation in the western Santa Barbara Channel with about equal strength in the northern and southern limbs of the recirculation.

Relaxation. The relaxation state is named for the time periods when winds off Point Conception “relax” from their usual equatorward direction. The relaxation state occurs primarily in fall and early winter. The relaxation state occurs when poleward, along-shelf pressure gradients overwhelm upwelling-favorable or weak winds. The most characteristic feature of the resulting flow field is a strong westward flow (>50 cm/s) through the Santa Barbara Channel and to the Santa Maria Basin. Flow in the Santa Maria Basin is strongest along the mainland coast.

The BOEM ran the GNOME model in three oceanographic regimes with oil being released continuously over 10 days, for releases at five locations distributed throughout the geographic range of existing offshore oil and gas operations within the Santa Maria Basin and Santa Barbara Channel: Platform Irene, Platform Hidalgo, Platform Harmony, Platform Hillhouse, and Platform Gail. Platform Elly in the Beta unit; San Pedro Bay, was not modeled because it is located outside of the model domain.

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